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STARVATION TREATMENT OF CERTAIN MALIGNANT GROWTHS

ROBERT H. M. DAWBARN, M.D.

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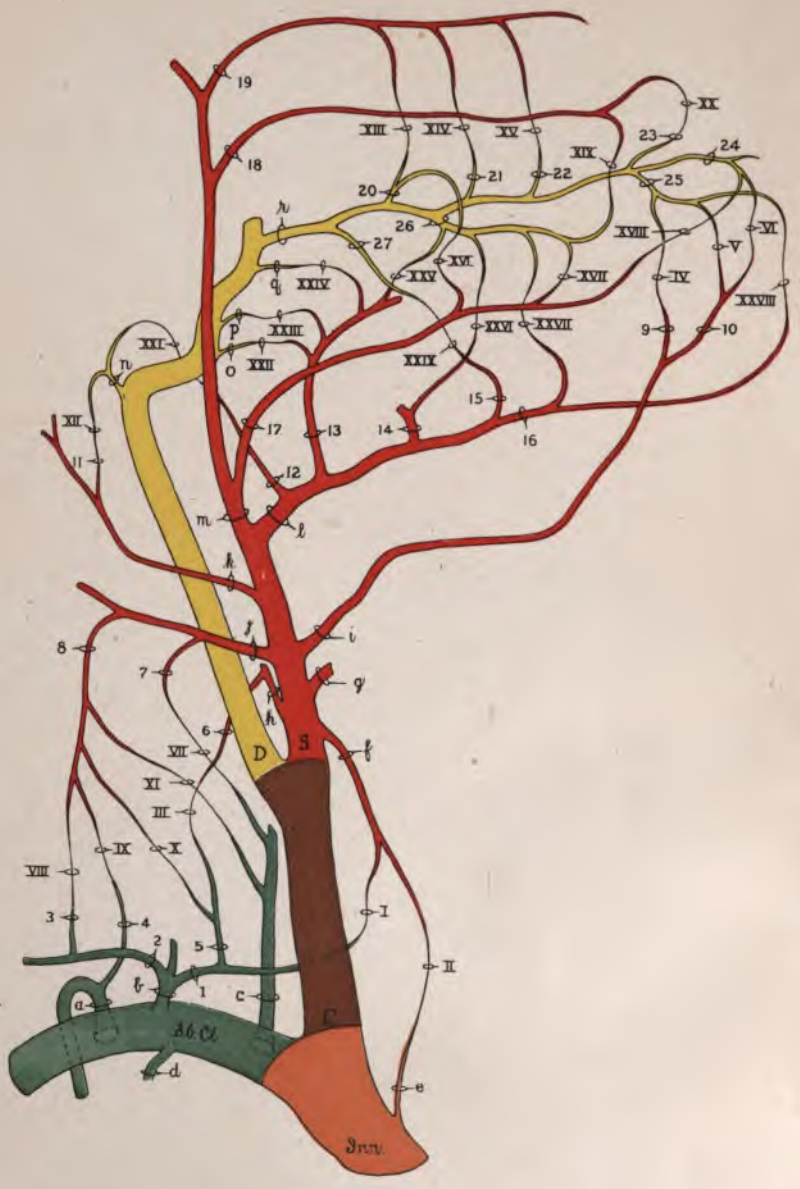

This illustration indicates the anastomoses of the branches of the artery which is the subject of this essay, showing especially the twenty-nine ways in which they communicate with other arterial systems. See Chapter VI, and especially pages 143 and 144.

THE TREATMENT

OF

CERTAIN MALIGNANT GROWTHS

BY

EXCISION OF THE EXTERNAL CAROTIDS

BY

ROBERT H. M. DAWBARN, M.D.

THE SAMUEL D. GROSS PRIZE ESSAY

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1825 PINE STREET,
PHILADELPHIA, January 6, 1902.

DR. ROBERT H. M. DAWBARN,
No. 105 West Seventy-fourth Street,
New York City.

MY DEAR SIR:

It gives me great pleasure to announce to you, on behalf of the Trustees of the Samuel D. Gross Prize, that they have awarded this prize of One Thousand Dollars ($1000.00) to the writer of the essay, "The Treatment of Certain Malignant Growths by Excision of the External Carotids" with the motto: *Non vi, sed sæpe, cadendo.*

The Trustees will forward a check to you very shortly for this amount.

Allow me to offer my congratulations upon this essay, which I consider a most valuable contribution to surgery.

Very truly yours,
WILLIAM J. TAYLOR,
Secretary of the Philadelphia Academy of Surgery and Trustee of the S. D. Gross Prize Fund.

JOHN B. ROBERTS,
J. EWING MEARS,
WILLIAM J. TAYLOR,
Trustees of Gross Fund and Library.

The conditions annexed by the testator are that the prize "shall be awarded every five years to the writer of the best original essay, not exceeding one hundred and fifty printed pages octavo in length, illustrative of some subject in surgical pathology or surgical practice, founded upon original investigations; the candidates for the prize to be American citizens."

It is expressly stipulated that the successful competitor shall publish his essay in book form and that he shall deposit one copy of the work in the Samuel D. Gross Library of the Philadelphia Academy of Surgery.

The award was made in the present instance after six years' interval; the judges having the right to determine whether essays presented during five years, or at a later period than this, shall be considered worthy of the prize.

Chiefly because of delays in the publication of the present essay, which have allowed of the admission to its pages of a number of additional histories and some further discussion, its length is considerably greater than at the date of its submission to the judgment of the trustees.

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INTRODUCTION.

To the Trustees of the Samuel D. Gross Prize of the Philadelphia Academy of Surgery:

GENTLEMEN:

In presenting the following essay in competition for the Gross Prize the essayist owes it to those who are to judge what the value of his work may be to the cause of surgical advance, and perhaps equally owes it to himself, to explain certain matters having a direct bearing upon the subject in hand.

This investigation was not begun nor continued with a prize-gaining object. More than six years ago[1] the thought arose which has resulted in much hard work ever since. Then and thereafter, only the truth, wherever it should lead, and not a determined effort to bolster up a theory, was its only object. In all this period of time he has allowed himself no formal publication of his work. Not a case, even, has been stated in detail in a medical periodical. Of course, from time to time he has exhibited patients in various conditions of convalescence, cure, or relapse, at surgical meetings. Only in this way, and by discussing briefly, at the same time, the theory upon which the work was being done, could interest be aroused whereby other surgeons would also be induced to try the

[1] Now seven years. This essay is printed more than a year later than the date upon which the decision of the Prize Committee was announced. While we regret this delay, it has allowed the admission to the list of our histories of a greater number of instances of the operation under discussion than would otherwise have been the case.

method, or perhaps send to the author malignant cases which they themselves considered otherwise hopeless of relief. In this way Drs. W. W. Keen and J. Chalmers Da Costa, of Philadelphia; also R. F. Weir, G. E. Brewer, J. A. Blake, H. Lilienthal, W. Meyer, A. B. Johnson, C. L. Gibson, J. F. Erdmann, George Woolsey, and H. D. Collins, all of the New York Surgical Society; A. L. Bristow, G. R. Fowler, and W. F. Campbell, of the Brooklyn Surgical Society; J. C. Munro, J. T. Bottomley, F. B. Lund, of Boston City Hospital; W. P. Nicolson, of Atlanta, Ga., and others, have been induced to operate by starvation.

It is but recently that the essayist has learned that such abstention from formal publication of his work has permitted of his being included within the list of competitors under the construction given to the terms of Dr. Gross's bequest.

The essayist's object in waiting during these long years has been twofold.

First, it was hoped thereby to accumulate a sufficient number of cases, at his hands and the hands of others, to be of more than trifling value when finally a presentation of the subject to the profession should be made. It is a disappointment to the author that even now the number is not large. A method limited to one field alone, or perhaps chiefly to that of the external carotid system, has not presented more than very exceptional instances justifying the attempt; and this although the writer's hospital is an exceedingly large one.

Where a radical excision of the growth was possible, its extirpation was, of course, the method of choice; and in every instance but one was performed. (Case VII, *q. v.*) It was chiefly those sarcomata and carcinomata of the region in question which were beyond hope of extirpation and yet not too cachectic or otherwise weakened to tolerate two rather severe surgical measures—one upon either side of the neck—that could be at all considered; and numbers of these refused the knife.

Again, the very fact of malignancy has compelled the writer to be slow in giving out his figures lest they prove deceptive in the claims made. Quite a number of those subjected to the starvation plan are still within the three-year danger-zone of Volkmann. There are several others, however, that have now long passed it, and may with some degree of certainty be considered cured. These are a comfort that words do not express, for each means a life saved that otherwise was hopelessly lost. They are an abundant reward for much hard work, and they lessen the bitterness of many failures.

The essayist begs to apologize for the absence of an extensive bibliography to accompany his effort. This absence does not imply, in this case, neglected research. It means that the topic in question seems a new one,—for nothing has been discovered in this field in the New York Academy of Medicine library nor in Washington, either by the essayist or by the following gentlemen, to whom his thanks are due, and especially to the first, and who have also among them examined the literature of four languages: Drs. Edward Preble, J. W. Draper Maury, and Alfred W. Haskell.

The bibliography of the predecessor of the new operation —*i.e.*, that of simple ligation of one or both external carotids in an endeavor to accomplish control of malignancy by permanent anæmia—will be found carefully studied and detailed herein. The results of this procedure have been far from hopeful, so rapid is the resumption, by many anastomotic channels, of free arterial circulation. But the facts as to starvation by carotid *excision* are far more cheering, if we may judge from the histories of certain cases appended.

In conclusion, your essayist would say that endeavor has been made to condense. Simply as one instance, reference may be made herein to the experiments upon dogs at the Physiological Laboratory of Columbia University. During the month of May, 1901, thirteen dogs were sacrificed to the necessary steps of the study of a certain phase of the topic. Detailed

notes were taken during the progress of the experiments by Dr. Malcolm Goodridge, and finally careful dissections of all these animals were made for the writer by Dr. H. E. Hale, Assistant Demonstrator of Anatomy in that college. To avoid prolixity all the unimportant details of these experiments are omitted; and only the chief results obtained, and a few interesting data, are described herein.

There will be found a systematic omission in these pages of long details of family history and of patients' symptoms having no especial bearing on the topic in hand. In each personal instance, and in almost all instances by other operators, a competent pathologist has reported upon the question of malignancy; no case being so classed except after such microscopical test. But the full descriptions by these gentlemen, often many pages long, to verify their diagnosis of some particular variety of sarcoma, for instance, have been omitted as needlessly adding to the length.

Perhaps it need not be said that without trouble the essay could have been extended in yet other ways. On the contrary, an effort has been made not to yield to the temptation of discussing several collateral and allied matters,—for example, the treatment of malignant growths by toxins; also by the Roentgen and the Finsen rays. Recently by these rays remarkably hopeful results have been obtained in certain cases of malignancy. But, unaccountably as yet, there are instances which do not yield to any of these means. For such as these it is well that the profession should know that the limit of our armamentarium has not been reached, and that in the carotid region the starvation plan is worthy of a trial.

It is, in conclusion, regretfully recognized by the essayist how far his essay falls below the standard of brilliant accomplishment. Much work remains to be done, and doubtless by many more operators, before the final word can be said as to the place in surgery which the method of treatment by permanent anæmia will rightfully occupy.

This is especially true in regard to Dr. Wyeth's recent suggestions of modifying the plan by filling the terminal branches of the external carotid with some plastic material. This opens a new field of work to which the writer intends devoting his best efforts in the immediate future, as he has during the past year or so.

CHAPTER I.

Historical Sketch of Ligation of the External Carotid Artery for the Starvation of Malignant Growths.

The history of "starvation-ligatures" in general begins with Harvey himself, and this resource of surgery appears to have been a direct application of the discovery of the circulation of the blood. From that epoch until the present time the idea has been kept alive in surgery, and at the recent International Congress at Paris, in 1900, Mauclaire, in the course of an article upon ligation of the spermatic cord for tuberculous epididymitis, gives a very complete *résumé* of the entire subject of starvation-ligature in all pediculated organs, whether the constriction was applied to the nutrient artery alone, the artery and its veins, the entire pedicle, etc., etc. Some of the organs which have been attacked by the starvation-ligature are the uterus, testicle, spleen, thyroid, tongue, etc.

The original principle of the starvation-ligature was clearly directed to organs having a single vascular pedicle. Thus, the celebrated case which goes by Harvey's name was a tumor of the testicle. From ligature in organs having a vascular pedicle to ligature of the carotids is a long step, involving a change of principle. No surgeon would regard any of the carotids as the sole nutrient artery in a case of malignant growth, but the extensive and sometimes fatal hæmorrhage incidental to removal of growths of the head and face would suggest the idea of ligature on hæmostatic grounds; and this hæmostatic ligature might come to suggest starvation-ligature.

The pharynx, floor of the mouth, tongue, etc., to say nothing of the tissues of the face, are the seat of many inoperable growths. Nothing would be more natural than to attempt to shut off the blood-supply in these cases, in the hope of securing

a favorable result at hap-hazard. But, if such operations were unsuccessful, they would not be reported; and, as a matter of fact, those who have undertaken these operations have very seldom rushed into print. The entire material of external carotid ligature has come into literature by the indirect route.

At this juncture it is well to mention that a sort of myth has grown up about these cases of ligature. At least literature contains cases of "ligature for malignant growths" in which the ligature was practiced on purely hæmostatic grounds, either before or during the operation. This looseness in reporting and editing has led to many blunders in contemporary literature, which is well shown in an attempt by Tuffier to sketch the evolution of ligation of the external carotid before the French Surgical Association in 1897. In this brief essay numerous misstatements are made. Thus, it is here stated that Travers first tied the common carotid for a fungus of the eye, when in reality the affection was an aneurism by anastomosis. The date is also given erroneously, Tuffier giving it as 1805 instead of 1809. Further on we read that in 1847 Nagel, a German surgeon, cured a malignant growth by ligation of the carotid. As a matter of fact, the treatment consisted in applying four ligatures to the base of the tumor itself. When a surgeon of Tuffier's eminence could present such inaccuracies before the French Surgical Association without being corrected, either in discussion or in some special article, it is very plain that the literature of the subject is badly in need of rewriting.

Ligation of the common carotid came into extensive vogue, after Travers's initial case, for tumors of the head and face, and gradually we see the idea adopted of tying one or both these vessels for malignant growths, chiefly when the latter were inoperable or had recurred after one or more operations. Such cases are hardly typical examples of starvation-ligatures, for they are undertaken apparently as a forlorn hope. Nevertheless, some of these early operators appear to have cured tumors, by this means, which were clinically malignant. Dr. J. A.

Wyeth, who in 1878 collected and analyzed all the cases of ligation of the carotids, claimed that a large number of these tumors were cured (Bryant, *Medical News,* volume l). But when we note the course of the majority of such cases treated by ligation and how promptly they resume their growth after a temporary stay, we are forced to assume that errors of diagnosis must have been responsible for permanently successful results. Cures by ligature in apparently malignant growths have sometimes been explained on the assumption that the neoplasm was of syphilitic nature.

Our principal authorities upon starvation-ligature are not found in the literature of tumors, but in that of ligation of vessels. In 1868 Pilz collected and published all the cases of ligation of the common carotid in the *Archiv für klinische Chirurgie,* volume ix; and ten years later Wyeth brought the material up to that date. Whether these tables have ever been extended to the present time, we do not know, but the material is now so large as to be unwieldy. Wyeth's article was devoted to the surgery of the three carotid arteries, and was published with the "Transactions of the American Medical Association" (1878), having been awarded a prize by that society.

In 1874 Madelung collected and tabulated all the cases of ligation of the external carotid for any cause (*Archiv für klinische Chirurgie,* volume xvii), and Wyeth four years later was able to add to this material in his prize-essay. In 1893 Lipps extended Madelung's table to that date, although his work was done entirely at first hand (*Archiv für klinische Chirurgie,* xlvi).

It is a singular fact that the elaborate work of these authors appears to be unknown to many contemporaneous surgeons. Had Tuffier, for example, been familiar with these tables he could not have written such a poor account of his subjects as we have already cited; and had his hearers and readers been better informed such statements would have been set right immediately.

The subject of ligation of the common carotid and of starvation-ligature as a general surgical resource must now be abandoned for future consideration, as the entire matter is in a chaotic state, and needs to be rewritten outright. As to the question "has simple ligation ever permanently *cured* malignant disease?" it must be answered that in some instances formidable and rapidly growing tumors *have* disappeared after ligation of the nutrient vessels, although there must always be some doubts, so incomplete are the records of these, as to the accuracy of the diagnosis of malignancy. It appears probably the fact that undoubted malignancy—as shown by glandular implication, cachexia, microscopical examination, etc.—has never been permanently arrested by ligature.

In regard to the external carotid, we find from the tables of Madelung and Lipps that it was first tied for a tumor of any sort about 1830. This ligature was not applied for outspoken malignancy until about 1854, at which period Maisonneuve endeavored to give the method a fair test. It appears that he performed unilateral and bilateral ligature collectively some seven or eight times, and that he secured no benefit from this intervention. The growths were cancers of the buccal cavity, tongue, and pharynx. Maisonneuve does not appear to have reported these cases at all; and they did not get into print until 1868, when Guyon, in the course of a paper on the ligation of the carotids, first recorded them, aided by a personal communication from the operator. These cases are given by Guyon without comment, mingled with cases of ligation for causes other than tumors. Madelung appears to have discovered them in the course of his work in compiling his table. Thus far it can hardly be claimed that there is any special literature for ligation of the external carotid for tumors. The next case to be rescued from oblivion belongs to Lannelongue. It does not appear that this case was ever reported specifically. The editor of "Schmidt's Jahrbucher" cites it, perhaps from memory, in the course of a general sketch of ligation of arteries

in 1875 (volume clxvi). The operation, he states, was performed "about two years before." Dr. Wyeth tabulates this case in his prize-essay.

We find no further record of ligation of the external carotid for starvation purposes until 1887. In volume I of the *Medical News* Dr. J. D. Bryant reports two cases, one of which ended fatally from hæmorrhage incidental to the sloughing which followed ligation. This case occurred in 1885.

Dr. Bryant looked up the literature of the subject, and states that he found mention of nineteen cases in which the external carotid was tied for malignancy, and that his fatal case was the only fatality recorded. No hint is given as to these cases, and while the author appears to regard them as examples of starvation-ligature, he has evidently been misled by Wyeth's tables, where a number of cases taken from Madelung's collection have been incorrectly or rather incompletely transcribed, Dr. Wyeth having neglected to add that the ligature was merely accessory to excision of the growth. We also note a case, related by F. H. Hamilton to Wyeth, which gives the impression that it was an example of starvation-ligature, yet in the result-column it is stated that the growth "returned," thus making it quite evident that it was excised.

We hear no more about these ligatures until 1897, when Tuffier reported a number of cases of ligation of arteries before the French Surgical Association. In attempting to write an historical sketch of starvation-ligature he is betrayed into numerous errors. His three personal cases of external carotid ligation are barely mentioned, nor does he state when, where, or how they were performed. In the discussion which followed Bousquet stated that the idea was an old one, and that he had seen Broca tie several arteries simultaneously for malignancy of the face.

In conclusion, we believe that this matter of starvation-ligature of the external carotid has now been set right for the first time; and that this account is at least correct as far as it

goes. Of the thirteen cases, not one was attended by a permanently favorable result, and there was one death from secondary mortality. But it must be remembered that most of the cases were desperate, and that ligature was merely practiced as a forlorn hope rather than as an indication of choice.

Every effort has been devoted to the search in four languages—English, German, French, and Italian—for any reference to the essayist's more radical idea of excising or ablating the external carotid for any purpose whatever; but this idea is evidently wholly new. Also, the further and recent suggestion (Wyeth's) of supplementing this excision by injecting boiling water or some plastic material into the terminal branches proves to be without literature upon the subject. The two following pages contain two short tables upon an historical *résumé* of the subject treated of in this chapter:—

TABLE I.—UNILATERAL LIGATION OF EXTERNAL CAROTID.

REPORT.	OPERATOR.	PATIENT.	DATE.	SIDE.	DISEASE.	RESULTS.
Guyon, "Ligation de l'artère carotide externe," "Mémoires Société de Chirurgie de Paris," vi, 1868, page 211.	Maisonneuve.	Male.	Jan. 21, 1855.	R.	Cancer of tongue.	No operative accident; patient died from the disease Feb. 15, 1855.
Same.	Maisonneuve.	Male, 42.	Nov. 23, 1855.	L.	Cancer of tongue and left jaw.	No operative accident; patient died of disease Jan. 24, 1856.
Same.	Maisonneuve.	Male, 51.	Feb. 14, 1856.	R.	Cancer of tongue, pharynx, and jaw.	Discharged May 3, 1856; no mention of results.
"Schmidt's Jahrbucher," Bd. clxvi, p. 149.	Lannelongue.	Male, 17.	1873.	?	Sarcoma of tongue and face. Inoperable.	Rapid improvement, followed by relapse.
Congrès française de Chirurgie, 1877.	Tuffier.	?	?	?	Epithelioma of ear.	Temporary benefit.

TABLE II.—BILATERAL LIGATION OF EXTERNAL CAROTIDS.

REPORT.	OPERATOR.	PATIENT.	DATE.	DISEASE.	RESULT.
Guyon. (See Table I.)	Maisonneuve.	Female, 32.	March 11, 1854.	Cancer of jaw and tongue.	No accidents; discharged May, 1854.
Same.	Same.	Male, 26.	March 21, 1854.	Cancer of tongue.	No accidents; discharged April 30th.
Same.	Same.	Male, 50.	March 28, 1854.	Cancer of tongue.	No accidents; discharged May 1st.
Same.	Same.	Male, 44.	Oct. 25, 1856.	Cancer of tongue.	Died Jan. 25, 1857, of disease.
J. D. Bryant, *Medical News*, volume l, 1887.	Bryant.		Feb., 1885.	Cancer of jaw, floor of mouth, and tongue.	Died of hæmorrhage from the tumor on ninth day after operation.
Same.	Same.			Cancer of jaw, floor of mouth, and tongue.	No operative accidents; no mention of result.
Tuffier, Congrès française de Chirurgie, 1897.	Tuffier.			Cancer of tongue.	Temporary improvement.
Same.	Same.			Cancer of tongue.	Temporary improvement.

NOTE.—A few additional simple ligations will be found among my own histories.

CHAPTER II.

Histories.

Histories are here given — arranged in chronological order—of cases subjected to excision of one or both external carotid arteries for attempted cure, or relief, of malignancy, by the essayist, and by the following gentlemen: Drs. Keen, Da Costa, Weir, Bristow, Brewer, W. Meyer, Blake, Lilienthal, Johnson, Gibson, Erdmann, Collins, Nicolson, Turnure, Clark, Munro, Bottomley, and Lund, with comments thereupon accompanying each history.

Case I.

Round-Celled Sarcoma of the Naso-pharynx.

Case of Charles Busse, 93 Bergen Street, Brooklyn, N. Y. In May, 1895, Dr. M. D. Lederman, of New York City, sent to the writer the above patient. German; *æt.* 26; no family history of malignancy; no venereal history, nor tubercular. A varnisher by trade. He was thin, pale, weak, and anæmic, but all organs were normal in function. For eight months past he had noticed in the pharynx a rapidly growing obstruction, first filling the right, then both nares, and finally rendering deglutition and respiration difficult—the latter chiefly upon exertion—and interfering with distinct articulation. It also caused severe headaches and dizziness. It bled savagely upon the slightest touch, and sometimes for hours would bleed moderately even without contact. When first seen by the writer the tumor filled the pharynx, bulged the hanging palate downward, and appeared below its edge.

Early in its history Dr. Lederman had ascertained that it sprang partly from the right middle turbinated bone, but chiefly from the base of the skull. Removal of a small piece by Dr. Lederman, and its examination by Dr. William Vissman, pathol-

ogist to the Polyclinic School, showed that it was sarcoma of the small, round-cell type.

Before placing him in my hands Dr. Lederman had made thirteen injections of the mixed toxins of bacillus prodigiosus and streptococcus erysipelatosus. The reaction was violent each time, a severe chill with rise of temperature to 104° F. and much exhaustion following. The patient refused a fourteenth injection, fearing it would kill him. No good effect upon the size of the tumor had been observed; it continued to grow steadily.

At this time another surgeon examined the case with Dr. Lederman, and declined any intervention whatever, pronouncing the case hopeless.

With the idea of giving temporary relief to his dyspnœa and dysphagia, the writer operated, upon June 1, 1895, hoping to shrink and starve, for a little time, the growth. The right external carotid was tied at its origin. It was contemplated to tie its fellow a little later. But within a week free pulsation could be noted in the facial, temporal, and occipital arteries of the ligated side. This was so discouraging that it was felt that (considering the freedom of anastomosis between the external carotid system of branches and other systems) too little would be gained to justify the ligation upon his left.

It was at this point that, after long reflection, the idea occurred to the writer of attempting a much more radical procedure, in an endeavor to secure permanent anæmia, with a possibility of more than temporary cessation of growth of the tumor in consequence. This procedure was to be a complete excision, from end to end, of the external carotid artery, tying and dividing between two ligatures each of its eight branches as it was reached. It was realized that it would be better to perform it upon both sides; but it could at least be tried upon one side, with the hope that the simple ligation of the external carotid which had previously been done upon the other side might not then be wholly valueless to the final result.

The difficulties and technic were carefully weighed and considered, and the operation practiced four times (two subjects) upon the cadaver before it seemed justifiable to attempt it upon the patient. Also the truth was carefully stated to him, namely: that it was proposed (since otherwise he was hopeless) to try a plan probably never before attempted, the

nature of which was made plain to him. He willingly consented, saying that life was unbearable in his condition at that time. Upon June 10, 1895, ten days after the initial operation already described, the operation of complete excision of the left external carotid artery was carried out, in the presence of the Polyclinic class and Dr. Lederman, and with the aid of Dr. E. L. Williamson, of New York, and the house staff.

This was the first time, so far as your essayist has been able to ascertain, that this operation was ever performed. It required forty-five minutes, and proved not difficult nor bloody. There was primary union. (Subsequently and by experience it has been possible to increase speed while maintaining safety of technique, and now twenty minutes to twenty-five minutes represents the average in uncomplicated cases. The ligature is placed about the external carotid in three minutes or less, upon the average, in such cases.)

The writer next saw this patient after returning from Europe in September of the same year; and was delighted to observe that in the interval between June 10th and that time the growth had shrunken to about a quarter of its former size. In this state it remained for about three months, and the patient said his health was greatly improved. Then it began to grow again,—at first very slowly, then with increasing speed. Evidently the anastomotic circulation was becoming gradually established,—of course, springing mainly from his right side.

He consented to operation for removal of the growth, and this was performed on January 14, 1896, at the Polyclinic Hospital. It was an entire excision of the right superior maxilla, except for the floor of the orbit, and also a chiseling away of a part of the basilar process, which was involved. It proved a desperately bloody operation, and this was a surprise to me, for I had not expected such a degree of absolute uselessness in this respect from the carotid ligation and the carotid excision already mentioned. Partly by packing, partly by most vigorous use of the Paquelin cautery, the bleeding was checked and the base of the growth was seared. By aid of 2 liters of intravenous saline infusion at 120° F., used during the operation, shock was prevented; and the wound healed kindly after the slough separated. It was now urged that he permit excision of the right external carotid, but this he refused, promising, however, to return for that purpose if there should be any recurrence of the

growth. In spite of our many misgivings he has remained cured up to the present date, September 8th, an interval of five years and eight months since the destruction of the tumor, and six years and nearly one month since the carotid excision.[1]

To-day there is distinct pulsation to be felt in the chief branches of the external carotid, upon both sides, in this man's case. It is very probable that his right external carotid, which pulsated so soon after mere ligation, is now responsible for most of this blood-supply upon both sides; and we may attribute the freedom from recurrence to moderately thorough removal of the disease by knife, followed by free use of actual cautery, rather than to such one-sided carotid excision. It is to be noted that in none of the writer's cases in which a complete *double*-carotid excision has been effected has any pulse returned, even after years, to any of the branches of this system of vessels. This case is chiefly instructive as showing the entire uselessness, in the long run, of doing the carotid excision upon one side alone. It also is memorable as the first of the list; and as demonstrating the practicability and safety of the new operation of carotid excision.

It should not be counted as a case cured by carotid excision, but this step produced a great temporary shrinkage, during which the patient's general health became much improved, thus fitting him to meet successfully the tumor excision, which otherwise must certainly have killed him by its gravity.

Case II.

Round-Celled Sarcoma of the Lower Jaw.

Patrick Callahan, Irish, seaman; *æt.* 36; unmarried, denies venereal disease except gonorrhœa repeatedly; no tubercular history nor history of malignant growths in his family. Admitted to the New York Polyclinic Hospital at request of his physician, Dr. William Vissman, upon October 3, 1895, to be prepared for operation. The patient was quite unintelligent, but Dr. Vissman's history states that the man's "disease began about four months earlier, and he attributes it to a blow from

[1] At the present date—March, 1903—he continues well.

a belaying-pin in the hands of a ferocious third mate of his vessel. This knocked out the lower central and lateral incisors, canine, and both bicuspids on his right; at least, such is his assertion, and they are the only teeth missing from a remarkably good set. Along the alveolar border (outer) slowly appeared a hard, red growth, which only within the past month has grown rapidly, doubling in size in the last fortnight. It now involves the soft tissues beneath the lower lip, which is tensely stretched over it, and also the chin upon his right, about two centimeters further than the angle of his mouth. Roughly speaking, the size of the mass is now about twice that of a hen's egg. It has within ten days begun to ulcerate, apparently from tension."

A small portion was excised by Dr. Vissman under cocaine and examined. He reports it to be "unquestionably a round-celled subperiosteal sarcoma of the mandible, originally limited to that bone and its periosteum, but now involving tissues external also."

The writer tested with a sewing-needle held firmly in the grasp of a holder and found that there was extensive decalcification of the lower jaw, with resultant softening, extending at least one centimeter beyond the apparent limits of the growth in each direction. (See also in this regard the history following this one; again, that of Mr. Arthur M. J., the lawyer, included among these histories.)

Upon October 5, 1895, assisted by Dr. William Vissman, Dr. E. L. Williamson, and two members of the house staff, the writer excised the right external carotid. The bifurcation into its terminal branches was fully three centimeters higher than the "tip of the lobule of the ear," the standard level; and it was not possible to ligate separately the superficial temporal and the internal maxillary arteries.

At the same sitting the lower jaw was resected, leaving little more than the ramus, on his right, and extending one centimeter to the left of the median line upon his left. The soft tissues surrounding the diseased part of the jaw were largely excised also. There was no encapsulation, unfortunately, and it was not possible to be sure as to the amount of tissue that should be sacrificed.

Done, as it was, immediately after the carotid excision, this attacking of the malignant growth proved to be almost

entirely bloodless. The wound in the mouth was well rubbed with aristol, no packing being used; and was flushed out by fountain-syringe each two hours at first. It did well. The neck-wound healed *per primam.*

Upon October 15th the remaining external carotid was excised with the same assistants. This proved uneventful, the work upon the vessels being completed in a half-hour.

The essayist asks that it be observed that, as the end of this day's operation, a step was employed, for the first time, to which he had given much thought, namely: excising also upon both sides a portion of the inferior dental artery and nerve. This was not difficult, though he regretted that it had not been thought of and carried out at the first operation, and before resection of the diseased jaw, for then the rami, upon which the work had to be done, would have been much steadier. (See "Technique" for reasons and steps.) Done upon both sides it added more than a half-hour to the time under ether.

Only in one additional instance has opportunity to do this inferior dental artery excision offered, which case will be found detailed hereafter (see page 19).[1] In certain other patients upon whom it would probably have been a wise step, cachexia and weakness demanded ending the operation with all possible dispatch, for otherwise a death from shock—perhaps even upon the table—was justly to be feared; and such additional lower-jaw cases have refused further cutting. But it is the essayist's opinion that the permanency of the cure in both cases upon whom this step (inferior dental) was taken may fairly be attributed in some degree to this additional help toward permanent anæmia of the bone involved. The removal at the same time of a portion of the inferior dental nerve was simply to render a possible recurrence *in loco* less painful.

This patient, Callahan, left the hospital early in November. There was considerable deformity due to lack of a chin, and to asymmetry because of the missing dental arcade—that upon his right; nor could we hope for redevelopment of bone to fill the gap, as the periosteum had, of course, been sacrificed. By

[1] In this second patient the inferior dental artery and nerve were attacked from behind the ramus, without entering the bone at all. The ramus, by sharp retractor, was held well out from the deeper parts, thus giving more room. By this means this work was much more quickly accomplished than in the present instance.

dental prosthesis, however, much might have been done for his appearance. He refused to allow further attention, having a strong desire to get away to sea, and asserting that, so long as he could live and chew tobacco upon one side, looks did not count with him.

We never expected to hear from him again, because of the roving nature of his occupation; but he appeared two years later—in November, 1897—in my office, and there was no sign of recurrence, nor was there any pulsation noticeable in any branch of either external carotid.

Upon February 20, 1901, the writer was surprised by a note from this man (signed with his mark), written from Belfast, and saying that all was well with him, there was no return of "the lump,"—and asking for a small loan of money, as he had been robbed while drunk.

It would seem as if this case may be safely included among the list of cures. Of course, it is barely possible that the direct operation upon the sarcoma might *per se* have sufficed. However, the prognosis in this region, from attempts to extirpate a non-encapsulated, rapidly growing subperiosteal sarcoma is not at all encouraging. Upon this point Butlin, in his work upon malignant diseases, states, speaking of just these tumors (page 138): "The course of the disease is almost always very rapid, and the patients die from exhaustion due to the growth and ulceration of the *recurrent tumors* [italics are mine] or from secondary affection of other organs."

Again: "Malignant disease of the lower jaw is very uncommon." The essayist feels that he has been fortunate in meeting several. Butlin states that in St. Bartholomew's Hospital, between 1887 and 1897, only ten cases of malignant disease of the lower jaw appeared: an average of one per year. The results of operation upon subperiosteal sarcoma of the lower jaw are "distressingly unsatisfactory" (page 144). He makes it plain that almost all die, though he does not give exact figures.

The writer considers, in view of these facts, this case and the second following to be perhaps the most remarkable ones in the entire series now being detailed; and respectfully submits that these permanent cures (for they may now perhaps be so classed), in the face of the almost invariable deaths following simple excision of the tumor, however radical in its

attempt, should have weight in determining the value of permanent anæmia as a means of preventing a recurrence.

Case III.

Sarcoma of the Upper Jaw.

Monica Klebr, Bohemian, *æt.* 24; maid-servant; single; no venereal, tubercular, nor malignant history. Has had trouble for a year past, consisting of pain and soreness of the teeth and alveolar process of the right upper jaw. She says that there has been for a year some swelling of the gum, and that with her fingers she has once removed a piece of "proud flesh." This was some four months before the essayist saw her. Upon examination a large epulis was found, apparently springing from the sockets of three of her teeth, and sprouting higher than their crowns; and these (the bicuspids and the canine) were loose. The gum was also much thickened over an area of three to four centimeters.

A piece of the epulis was removed, February 4, 1896, and examined by Dr. Vissman, the pathologist of the Polyclinic School, and proved to be giant-celled sarcoma. Accordingly, a week later, with the assistance of the house staff of the Polyclinic Hospital, this was ablated, the loosened teeth being drawn and the entire alveolar process adjacent being also gouged away, including a part of the floor of the antrum. At the same operation, and prior to the mouth-work, her right external carotid was excised; and, ten days later, the left. Both operations proved easy of accomplishment. Primary healing of both neck-wounds, and the mouth healed satisfactorily also.

During the last operation the twelfth nerve was unfortunately nipped by an artery forceps at the point where it crosses the occipital artery. In consequence, her tongue on the left side was partly paralyzed up to the time when the writer last saw her, which was a year after this accident. It seemed not to affect her speech much; but the tongue when protruded deviated to her left, from paralysis of the left genio-hyoglossus. Upon July 24, 1897, Mr. John F. Calhoun, of 22 West Sixty-

first Street, New York, her employer, wrote to say that the girl had left him and accepted service in a family (name unknown) who had moved to Birmingham, Ala. The writer heard from her last through a chance acquaintance about three years after the operation. She was then well and without recurrence of the growth. It is presumable that this case may be accounted a permanent cure, and especially so since myeloid sarcoma is the least liable of any kind to recur after removal.

It may be of interest to note that in the instance of this patient, as with a few others in our list, there was distinct evidence of anastomosis between the two ranine arteries just at the tip of the tongue. After the right external carotid had been removed (of course, involving ligation of the lingual) this side of the tongue looked pale and noticeably smaller than upon her left, as regularly is the case; but in this instance its tip for a sharply marked short distance—about one centimeter—upon the right remained of as bright red a hue as upon the left, the as yet unligated side.

It will be recalled that the famous anatomist Hyrtl denied the existence of this anastomosis. The essayist has, however, been able during this series to convince himself that at least sometimes it does exist.

Case IV.

Subperiosteal Round- and Spindle- Celled Sarcoma of the Lower Jaw.

Case of Antonio Sainte Maria Cesare. Patient speaks a patois that even another Italian in the ward could hardly understand. However, the following was fairly clear: Nationality, Italian; modeler of plaster-of-Paris images; widower; *æt.* 29; no children; always healthy; no venereal history, nor tubercular. No family history of any cancers; no traumatism claimed as a cause. All his organs are sound. Pale and anæmic; cachexia perhaps due to tumor, but complains that the pain of it has kept him awake much at night for some weeks; and this suffering and broken rest may, in a measure, account for his haggard appearance. Also thinks the tumor has been notice-

able about two months, but has had pain in that region for as much longer.

The patient came to Dr. William Vissman (pathologist to the Polyclinic Hospital), introduced by another Italian. At this first visit Dr. Vissman removed a small piece of the growth, by aid of cocaine; and upon microscopical examination it proved to be a mixed round-celled and large fusiform-celled subperiosteal sarcoma. Patient admitted to the New York Polyclinic Hospital, February 12, 1896. Upon examination a tumor, irregular in outline, hard and nodular, is found, springing from the right side of the lower surface of the body of the mandible, about midway between symphysis and angle of the jaw. The growth extends beneath the mucous membrane of the floor of his mouth and involves the side of the tongue in its deeper portion. The shape is quite irregular, but perhaps the bulk would be the size of a small fist. It has begun to ulcerate, seemingly from pressure, at the floor of the mouth, and movement of the tongue is limited and a little painful.

It is worth noting that in this, as in the case just preceding, a surgical needle readily detected bone-softening even beyond the apparent limits of the growth. Butlin makes no allusion to this sign of malignancy, which, while not pathognomonic, the writer considers highly significant and worth recording.

The patient's pulse was 120 at this examination. Because of its speed and poor quality, and because the extension of the growth was in such irregular fingers or projections, as it were, that a huge operation for its entire eradication would have been necessary, it was decided that in this case starvation alone should be attempted, as being less perilous—thus leaving the mass in place. A consultation of surgeons of the hospital decided that he would probably die of shock were excision of the tumor attempted.

Upon February 19, 1896, the first carotid excision was done upon this patient. (The week before had been devoted to an endeavor to tone up his strength and vital powers by small doses of strychnine, milk-punches, codeine at bedtime to insure relief from pain and consequent sleep, etc.) The operation was upon his right side—that of the tumor—and lasted about a half-hour; but immediately following it a further ten minutes were devoted to exposing and tying off the inferior

dental artery and its mylo-hyoid branch; also excising about two centimeters of the inferior dental nerve as it was about to enter its foramen in the ramus.[1] It was thought that in this way the suffering from the tumor would be lessened, in event of renewed activity of growth, since this nerve was its chief source of sensation. As to the inferior dental artery, the free anastomoses between the internal maxillary nest of branches, of which it is one, and the internal carotid system made this ligation seem a wise step, in addition to excising the external carotid.

The pulse was now over 140 and very weak. Preparations had meantime been made, and, while the nerve-work was being completed, the house surgeon was introducing hot normal saline solution into the median basilic vein. Two liters were used, requiring nearly a half-hour, and maintained at a steady temperature of 120° F. To this measure, as well as the use of prolonged hot saline injections by rectal tube for several hours subsequently, is due, in all likelihood, the avoidance of a fatal degree of shock in his weakened constitution. The recovery was without incident, and the wound healed *per primam*, except for a slight accumulation of dark, fluid blood, which necessitated opening a couple of stitches over the trephined region for its escape, upon the fourth day.

The man said he had much less pain in the growth from the date of operation, and he slept without further use of the codeine.

Upon March 1, 1896, with the same assistance, the operation was duplicated upon his left, including the left inferior dental nerve and artery, and also the use of hot saline intravenous infusion. Time, one hour and five minutes. The patient recovered well, and save for a superficial infection, which compelled removal of a number of stitches, the healing was uneventful.

The tumor now became gradually very noticeably smaller. The man reported at my office perhaps a dozen times, as ordered, during a period of four months, then ceased to come. Two months later I looked him up, with some difficulty, as

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[1] See footnote on page 14. Upon the room for work behind and beneath the ramus and the shape of the jaw will depend the decision whether to trephine the ramus as in Case II or not. Where possible, the technique used in Case IV is preferable, because quicker of accomplishment.

he had changed addresses several times. The lump was about one-half the size when first admitted to the hospital. In shrinking it had somewhat bound the tongue to itself at the side of the jaw, interfering with volubility. He was free from pain, but complained much of the inability to move his tongue about. I thought it best to "let sleeping dogs lie," and declined to do anything for this; explaining, through an interpreter, that he ought to be grateful for having his life saved, and not consider this lesser matter; but he continued to look displeased. He would not agree to continue reporting at my office.

One year later I again tried to look him up, without success. But in the autumn of 1898 an Italian in the City Hospital, New York, a patient in the surgical service of my colleague, Dr. George E. Brewer, stopped me in the ward and said that he was a brother-in-law of Cesare's, his sister, now dead, having married Cesare. He assured me that my patient, who was then living in Palermo (having gone back to Italy permanently), was still alive and quite well.

For the purposes of this essay the point was again looked up in August, 1901.[1] The brother-in-law, seen at his tenement-house in this city, then assured me that Cesare was in good health; that his tumor remained small; and that he judged from remarks when he (C.) writes that Cesare continues to feel resentful about his bound-down tongue, for he asserts that any and all Italian surgeons would have done a workmanlike job, which he claims I did not do, but bungled the case.

From this deliverance of opinion we may fairly conclude that Cesare is in truth still alive and well, and displaying the customary gratitude of charity patients toward their medical attendants.

It will be noted that between the date of the first carotid excision upon this patient and the latest date recorded a period of nearly seven years has elapsed. Surely this most interesting case may fairly be classed as cured. In considering the matter we must remember, too, how exceedingly hopeless is the prognosis ordinarily made, by all writers, in the case of subperiosteal sarcomata of the lower jaw.

As the inferior dental artery is the chief source of nutrition of the lower jaw, it seems likely that the special attention de-

[1] Again in December, 1902. No change.

voted to this vessel helped the permanency of result, in both this case and Case II.

Differing from the case of Callahan, already detailed, the work upon the inferior dental was made easier by the steadiness of the mandibular bone, which was not divided. And in another case similar to Callahan's (*i.e.*, one in which a resection of this jaw with its tumor is to be done), the writer would operate in the following sequence: First, the external carotid excision, and that of the inferior dental vessels and nerve, upon the *sound* side (for reasons named under "Technique"). Second, this operation duplicated upon the diseased side. Third, the division of the jaw at two points, preferably by the Gigli saw, and excision of the diseased portion and the rest of the tumor. Each of these operations should average at least two weeks apart, for time to recuperate.

Case V.

Carcinoma of the Tongue.

Mr. Engel, German, *æt.* about 45. Sent to me by Dr. F. Van Rensselaer Phelps, of this city, for epithelioma of the right side of the tongue, of about six months' duration. Admitted to the Polyclinic Hospital and first operated upon March 5, 1896. The writer advised removal of the entire tongue, as the growth went nearer to the median line of the organ than was thought safe; but the man would only permit excision of half of it. At this operation the right external carotid was extirpated, and a Kocher operation performed immediately afterward, Dr. Phelps and the house staff assisting. The excision of the artery proved simple, taking twenty-five minutes to perform. The Kocher tongue-operation was practically bloodless. The stump of his twelfth nerve was carefully attached with fine catgut through its sheath to a cut in the raw surface of the stump of the tongue, which was about two centimeters above the hyoid bone. This technique the writer believes original with himself, and thinks he has seen evidence (though not in this case) in a more rapid recovery than otherwise of control of the act of protecting the larynx during swallowing by pushing

down the epiglottis. This action by the stump is, of course, extremely important to regain, as, until accomplished, there is great danger of *schluckpneumonie.* It seems far from unlikely that the twelfth nerve, a purely motor one, may in time innervate what remains of the muscular intrinsic mass of the tongue upon its own side.

We were also careful in this case, as always after tongue excision, to have the bed-foot so raised upon chairs, with entire absence of pillow or bolster, as to prevent the septic saliva and purulent secretions from the unhealed surfaces from running down the trachea and bronchi by gravity. This seems extremely important, when one considers the frequency of septic pneumonia as a cause of death after such operations upon the tongue; and this posture should be maintained until either the stump, and sound side of the tongue, have regained power to control the epiglottis perfectly—as evidenced by the patient drinking cold water without coughing—or else until the healing has been completed and the saliva become odorless again, even though this take a number of weeks.[1]

The writer can but express surprise, in this connection, at the advice given in the "International Text-book of Surgery," volume ii, page 40, where, under the heading of operation for cancer of the tongue, is found the following as to the after-treatment: "As soon as possible the patient is made to sit up, and even get out of bed, for in this way he gets rid of the saliva and discharges much more easily than in the recumbent position."

Butlin, upon malignant diseases, page 162, states that after operation upon cancer of the tongue septic pneumonia and general sepsis killed twelve cases, while shock, "exhaustion," and hæmorrhage were the causes of death in eight cases. Hence the greater number of deaths is from the cause which the postural treatment the writer deems essential would go far to prevent. As to the remaining eight fatalities, according to Butlin, it seems so plain to the essayist that it almost appears incontrovertible that they were principally due to hæmorrhage—that chief cause of shock and "exhaustion"; and that a preliminary ligation (or excision) of the external carotid, or even

[1] The reader is requested to note, in this respect, the history of Case VI, of the present series.

tying the lingual artery, would by making the work nearly bloodless have removed this great peril. Butlin does not advise ligation of the carotid prior to any bloody operations whatever. The essayist is convinced that time will show him the error of this view, and that he will be frank enough to acknowledge it in a subsequent edition, as he already has altered certain opinions held in the first edition.

The writer would not, as a rule, advocate excision of one external carotid and of cancer of the tongue at one sitting. In this patient it was done, but he was quite exceptionally strong at that time. If the carotids are to be excised, as a rule, the tongue should be the second or third of the series of operations, with intervals long enough for recuperation. It may well be the second, in case only one-half of the tongue is to be sacrificed.

Healing was without event in Mr. Engel's case. The Polyclinic pathologist, Dr. W. Vissman, reported the growth to be epithelial cancer; but this was so typical a case that I went ahead without waiting for his report.

Excision of the other external carotid was strongly urged, but this man refused point-blank to submit to anything further. Very promptly the unwisdom of this was evident, for within a few weeks the cancer appeared in the remaining half of the tongue. In a very cachectic condition he returned and was readmitted, the mass then nearly filling the mouth. He was still unwilling to have the carotid operation done. Accordingly the tongue alone was attacked. (The writer had intended to remove this as a distinct operation, after excision of the left carotid, had the man permitted this.) He did badly after the operation, which was a very long one, as there was a wide extension in the floor of the mouth; and died about forty-eight hours later, of shock.

As the Polyclinic fire in December following destroyed the records, the writer asked the help of Dr. Phelps's memory. In a letter dated July 22, 1897, he replied, concurring, as to his recollection, with the above-named facts, but was unable to enter into fuller details regarding previous history, etc.

This case is one of the few in the series where the carotid excision was performed upon one side only. To do this and not to repeat it is apparently almost useless, so far as preventing extension of the disease is concerned.

Case VI.

Carcinoma of the Mouth and Mandible.

Patrick Holahan, Irish; *æt.* 54; married; laborer. Admitted to Polyclinic Hospital from the Dispensary Department on March 15, 1896. Condition, very weak and cachectic. His mouth was in an outrageously offensive state from neglect; so much so that in spite of abundant use of antiseptic mouth-washes (tooth-brush refused with contumely) his presence in the ward was at first a nuisance. His tumor was of about a year's duration, its growth being of terrific rapidity of late. He did not know where in the mouth it had commenced. It now involved the whole tongue, floor of the mouth, and lower jaw, as far back as the rear molar teeth, on both sides, and as far down in front as the hyoid bone; though the skin of chin and neck seemed as yet free. The jaw-bone was decalcified and soft. The incisors had all dropped out. The other teeth were loose. The mass of growth, very soft and vascular, and discharging quantities of offensive pus and stringy mucus, was so large that he could with difficulty swallow even fluids, and could not make himself understood by speech. The growth protruded three centimeters in front beyond his teeth, and his lips could not be made to meet over it.

Obviously this was a case in which the excision could at best give only a short respite. Nevertheless this was not refused him. Dr. Vissman's report upon a piece cut from the growth was: "a typical epithelioma." The writer operated upon St. Patrick's Day, March 17, 1896, before the class at the college. First, the left external carotid was excised, together with a quantity of diseased lymph-nodes. These last were so firmly adherent to the deep jugular vein that three inches of the vein were removed, between ligatures. The use of 2500 cubic centimeters of hot salt-water in a vein at the bend in the elbow, while still upon the table, probably prevented his death from shock. Primary union followed. Two weeks later, upon March 31st, the remaining external carotid was excised. Immediately afterward the entire tongue was removed, from within the mouth, almost wholly by sharp spoon, and with this same instrument the greater part of his lower jaw was also

cleared away, leaving only the ramus and about two centimeters of the body adjacent, on each side.

During this clearance, which was almost a bloodless procedure, he inhaled a piece of the crumbling growth, and was on the verge of death from suffocation. Instant laryngotomy saved him; and through this little wound, with the handle of the scalpel, the operator then pushed up this piece of tumor out of his larynx.

This carotid wound, like the first, healed *per primam.* As to the management of the great cavity left where his jaw and tongue had been, after thorough washing, this was lightly rubbed with aristol everywhere. No packing was used—it would have been soaked with saliva in a very few minutes. A large drainage tube was passed through the most dependent point: the skin just above the hyoid bone. His mouth was flushed with warm Thiersch solution, by a fountain-syringe, at hourly intervals by day, and three-hourly ones by night. His epiglottis seemed not diseased, and stood upright above the front of his larynx, not closing down in the act of swallowing.

He could not swallow without inducing coughing, and from the first moment after the operation (and, indeed, during it also) was placed with his head lower than his chest, so that neither saliva nor food could by gravity enter his larynx and passing down start a *schluckpneumonie.* All his food he swallowed uphill, so to speak, and without much difficulty after the first three days, during which time he was fed by peptonized milk enemata and also through the stomach-tube.

He did well for nearly three weeks,—his bed always kept in this slanting position, and no pillow allowed him,—and his baggy mouth-cavity had contracted to perhaps one-third of its first dimensions, and was covered with healthy granulations. The secretions were odorless, though there was still free suppuration. At this time even his second carotid wound was solidly healed, as was also his laryngeal incision, and all dressings were removed. Because he begged so hard to be permitted to sit up, and felt so well, we now with misgivings permitted this.

With very significant promptitude this patient developed a double pneumonia, and died of it April 24, 1896, within a week after he had been allowed up. This was five and a half weeks after the first, and three and a half weeks after the sec-

ond carotid excision. Obviously his death should not be attributed to these operations. Permission to make an autopsy was refused by his friends.

The writer has now had two deaths—of which this is one—which he attributes directly to the posture of his patient after a tongue excision for cancer; and, although it is a side-issue as to the matter especially now under discussion, it may be permissible to digress, because of its great importance, to a slight extent. (See remarks at the end of case of Engel.) In this case, as in Engel's, the Polyclinic fire, destroying the records, obliged the writer to depend upon a few personal notes for the history, and a few of the details. Others were regained by aid of the memory of witnesses of both operation and subsequent treatment.

The case is of value, as to the topic of carotid excision, chiefly as demonstrating twice more its comparative safety as an operation, even in a very cachectic case such as this was.

Case VII.

Spindle-Celled Sarcoma of the Antrum.

Mr. A. M. J., American; lawyer; *æt.* 26; married. Family history negative; no venereal history. In August, 1895, noticed a slight swelling of the gum opposite the first and second bicuspid teeth of his upper jaw, left side. By October of the same year a slightly greater degree of swelling and some aching. As this persisted and was attributed to toothache, he had the second bicuspid drawn. Its root was found to be *distinctly a little soft at its tip*, evidently the result of a process of decalcification. The gum was twice lanced, but without benefit. In April, 1896, he was in much the same condition, with a very slight degree of swelling also of the roof of his mouth, upon the left side. He went at this time to Dr. J. Morgan Howe, of New York City, a dental specialist, who strongly suspected malignancy and sent him to me. A simple test was made which has in a number of instances given me rather early warning of trouble, namely: the power which malignant bony growths some-

times manifest of decalcifying for a considerable distance the otherwise seemingly healthy bone which surrounds them, and upon or in which they are growing. By use of an ordinary sewing-needle (used instead of a surgical one in order to cause less bleeding) it was made evident that the palatine process of his left superior maxilla, as also portions of the alveolar process, and the bone over the front of the antrum, were penetrable about as readily as fibrocartilage would be; whereas unless this pathological condition were commencing, the bone here, normally exceptionally dense, should not permit a sewing-needle to engage by so much as its point. (His upper jaw and tumor are preserved for the inspection of any who may be interested in this matter.)

It was now readily discovered in this way, also by electric-light test, that the entire antrum was filled with a solid new growth. It will be remembered that the fang of the bicuspid extracted six months before, and which ought to have been of the stony hardness normal to the crusta petrosa, was soft at its tip. This should at once have awakened suspicions of the trouble. At the socket of this bicuspid the essayist removed a piece of softened bone and sent it to Dr. Vissman, who pronounced it large, spindle-celled sarcoma.

This patient was admitted to the Polyclinic Hospital, and there, upon April 18, 1896, the writer excised his left external carotid, assisted by the house staff. Primary union followed. He was dismissed for a short period for recuperation; after which, in Dr. E. Eliot Harris's private hospital in this city, the work was resumed and completed. Upon May 2, 1896, assisted by Dr. Howard Gillespie Myers and Dr. Edward L. Williamson, and in the presence of Prof. Joseph D. Bryant, we excised his right external carotid and then the left superior maxilla, the latter operation being an almost bloodless one. The orbital plate was included in the removal.

Upon this occasion the writer had, for the only time in his experience, the mishap of tearing across the carotid upon which he was working. The point of breaking was at its extreme upper end, high in the substance of the parotid gland. It is always necessary to pull downward upon the vessel rather vigorously here, while freeing it from the gland, in which it is imbedded, by *stretching* a passage by use of dressing forceps. One wishes to slip the final ligature up until it shall surround the bifurca-

tion, when possible. In this instance the pull was too hard. Fortunately, no bleeding whatever followed the rupture.

The neck-wound healed by primary union; as also did the skin incision in the jaw operation. The results were ideal. The patient, who is also a personal friend, presents himself for examination frequently. By use of a prosthetical dental appliance—a half upper denture with a "plumper" for the cheek—the deformity is scarcely observable. The writer has seen him, in perfect health, within the present month of March, 1903. Now that a period of nearly seven years has elapsed since his first operation we may presumably reckon him among those definitely cured.

Case VIII.

Recurrent Sarcoma of the Neck.

(Reported by Prof. John Chalmers Da Costa, of Philadelphia.)

By permission the writer quotes from his letters as follows[1]:—

"July 15, 1897. I am very much obliged to you for writing, and was profoundly interested in the views you set forth [as to carotid excision]. The results are truly remarkable, and are of such a character that it becomes the duty of every surgeon seriously to consider them. At the first opportunity I will certainly undertake the operation and will communicate to you the result."

"September 30, 1897. Immediately on receiving your note of July 12th I started to look up my case of recurrent sarcoma of the neck. When last I saw him there was an oozing mass (sarcoma) springing from the site of the old operation (lateral pharyngotomy), projecting into the mouth and pharynx so that the little finger could not be passed by it. It oozed blood constantly, and every few days there was profuse bleeding (on several occasions over a pint). Externally, there were several

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[1] This permission referred to printing, whenever the writer should decide to do so. Dr. Da Costa did not allude to the prize [illegible]n.

enlarged glands, and a mass beneath the body of the jaw on the left side two-thirds the size of the fist.

"When I saw this patient again to propose carotid excision, his condition was dreadful, and he seemed to be on the point of almost immediate suffocation. I performed your operation upon him about five weeks ago,[1] kindly assisted, the first time, by my colleague, Dr. R. A. C. Wood. During the administration of the anæsthetic he stopped breathing. I hastily performed tracheotomy, but artificial respiration was employed for many minutes before he began to breathe voluntarily. I then extirpated the right external carotid artery, and was surprised and delighted to find how easy the operation was. His condition did not justify the immediate extirpation of the other vessel. During the few days following this operation the growth shrank most decidedly, became harder, and ceased bleeding. Into his pharynx two fingers could be passed, over the growth, where before not even the little finger could be entered. The mass beneath the jaw, outside, diminished one-third.

"The presence of the tracheotomy wound caused me to delay the second operation. I waited for it to close entirely, but now believe it would have been wiser to have operated earlier. After about two weeks (I cannot tell exact dates, without consulting the hospital records) I operated upon his left side. Mindful of my experience before, I used eucaine anæsthesia this time; and this proved entirely satisfactory. I extirpated the left external carotid without trouble.

"The patient did very well for several days, when he was very suddenly seized with a suffocative attack. The house surgeon reopened the tracheotomy wound, but could not save him. The carotid wound was in an aseptic condition, and I am certain the second operation was *not* the cause of his death. I may not have been judicious in applying this operation to such an advanced case, but I am certain that the growth was profoundly modified for the better. I am very greatly impressed with the value of the operation, and Dr. Keen is waiting, as I am, for some other case upon which to test it."

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[1] This would be about August 26, 1897; the second excision being performed upon September 9th.

Case IX.

Giant-Celled Sarcoma of the Upper Jaw.

Patient, Henry Walker, is English by birth, a coalpasser upon ocean-liners; *æt.* 23; unmarried; home in Brisbane, Australia. Has had gonorrhœa, chancroid, and syphilis, for the last of which he has taken medicine for two years past, more or less faithfully. No present manifestations of its existence. No family tubercular history, nor that of malignancy. Organs all normal in function. Not especially anæmic nor cachectic in appearance. Comes by suggestion of a friend, who is an orderly in the Polyclinic Hospital. Upon examination presents a long, smooth swelling in general shape and dimension like the little finger, upon the left side of his upper jaw just above as well as involving the alveolus. In other words, the usual shape of the alveolus is modified by its being apparently a half thicker as well as higher upon this side than upon his right. He has no teeth at all upon the affected side of the upper jaw, and only two molars upon the other; says that as fast as any teeth have begun aching, all his life, he has had them pulled, as being the shortest way out of the trouble. Has worn a plate of artificial teeth until within nine weeks past, when the swelling began. Attributes this tumor to the plate, which was a very cheap one, fitting badly from the first. Examination with surgical needle shows slight degree of softening of the bone, and this extends about one and one-half centimeters higher than the apparent limits of the disease; in other words, involves the anterior wall of the antrum to perhaps half its height. The man has naturally a rather full, fleshy face, and casual inspection shows no evidence of anything wrong. But on digital contact a bony prominence as just described is instantly recognized, through the lip, upon his left.

A piece was removed under cocaine. Dr. William Vissman, pathologist to the Polyclinic Hospital, reports upon this that it is a myeloid sarcoma.

Patient was admitted to the Polyclinic Hospital upon September 9, 1896. He positively refused to have the operation performed which I advised, namely: removal of the entire left upper jaw except perhaps the orbital plate. Upon his promise, as he valued his life, to report to me once a month

for at least three years either in person or by letter, I determined to let it alone, and to excise his external carotids and then keep a close watch over him,—believing that it would be a fairly easy matter to observe renewed activity in its growth, if any; in which contingency I would again endeavor to get his consent to a radical excision of it. I intended to take plaster-of-Paris casts of his upper jaw, as dentists do, at stated intervals, for purposes of comparison; also to test by needle for any extension of the bony softening at the same periods. It seemed a fairly safe programme, especially as giant-celled sarcoma is the least malignant of all; and if successful he would be spared a very severe and somewhat mutilating operation.

Upon September 11, 1896, the operation was performed upon his left carotid. Upon September 21st it was repeated upon his right carotid. Each operation proved simple, and required about a half-hour. Both wounds healed kindly. He left the hospital nine days after the last cutting. He reported twice as agreed, at monthly intervals. Each time the growth was distinctly diminished in size. Then he called to say that he was going home to Brisbane. His father was suffering with what I recognized from his description as filarial disease, and needed him badly.[1]

I have not seen him since, though he wrote once, about a year after the operation, saying that the growth is still there, but very small; as it had stopped shrinking and remained the same size now, he was going to have another plate with teeth made. A letter from me after a further year brought no reply. Consequently we cannot consider this as being certainly a permanent cure, although it would be pleasant to adopt Butlin's favorite theory that cases not traceable are cases that have remained well. (The wisdom or unwisdom of adopting the plan of treatment used in this patient's case will be found discussed in Chapter IV.)

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[1] He referred to his father's urine looking at times exactly like milk, and said the doctors found "worms" in his blood that appeared there at night, and added that this trouble is rather common about that region in Australia, which I had not before known.

Case X.

Sarcoma of the Lower Jaw.

John O'Donnell, Irish; laborer; married; *æt.* 45; no malignant nor tubercular family history. Denies venereal. Organs all sound. Admitted to Polyclinic Hospital during the last week of November, 1896. The writer has to thank Dr. A. H. Brockway, of Brooklyn, N. Y., whose specialty is dentistry, for this case. He wrote as follows:—

BROOKLYN, July 21, 1897.

MY DEAR DOCTOR:

I will with pleasure comply with your request for further data in regard to the carotid case I sent you, so far as I am able. He first came to me on November 10, 1896, complaining of much pain in the right side of his lower jaw at the site of the third molar tooth, which he said had been extracted at some "Dental Association" about a month before. I found the neighboring parts much swollen, the gum-tissue having an exceedingly dark and angry appearance. Finding the second molar very loose, and presuming that it contributed by its presence to the irritation, I removed it, and, bathing the parts with phenol-sodique, dismissed him with directions to call again if not improved. He came in again, a fortnight later, with all the symptoms aggravated, and I then saw he required the services of a general surgeon, and sent him to you.

You removed his right external carotid, also freely gouging away the right alveolar process, at the Polyclinic Hospital, in my presence, upon December 1st. The succeeding operation on his left carotid was made one week following, but I did not see that, much to my regret.

Most unfortunately the fire in the hospital, which occurred on that bleak Christmas Day, caused him to be greatly exposed. Pneumonia set in, and he died in the early part of January.

With sincerest regards I am, etc.,

A. H. BROCKWAY.

The writer has to depend for certain of the foregoing details upon Dr. Brockway, and his letter in referring to the fire explains why in this, as well as the instance of a few of the cases of our list, the record is deficient in details. In some instances personal notes had been entered upon my books at home, and these helped out, fortunately. All the hospital records, however, were burned with the building. Still, the essential facts for the present purpose are all here. The pathologist of the Polyclinic, Dr. William Vissman, examined a piece gouged from the gum and alveolar process before the operation, and pronounced it giant-celled sarcoma. Both ca-

rotid wounds healed *per primam.* He was well so far as these were concerned when removed from the Polyclinic Hospital. Dr. Brockway was a little in error as to the ending of his letter. By Professor Pryor's careful management not one of our patients suffered from exposure that bitter day. Hearing at an early moment of the fire, he hurried there, and, being then chief of the Hospital Committee, gave his directions, and these were calmly carried out. All female patients were carried to the ground floor and laid in rows in a certain large room, each well wrapped in blankets. Then the same was done for the male patients in another room on the ground floor. Meanwhile all the ambulances obtainable were rung up. And when it became evident that the whole building was doomed, the patients, well protected against cold, and not in a state of fright, were rapidly dispersed among the waiting ambulances and taken to various hospitals. The patient in question was admitted to Bellevue Hospital. There he did perfectly well, but after a week or so more insisted, against medical advice, upon going home. This long trip he made in piercingly cold weather, and caught pneumonia then, of which he died some days later.

The case is of interest chiefly as representing the safe excision, in two more instances, of the entire external carotid, thus bearing upon the question of risk of this new operation.

Case XI.

Sarcoma (Mixed Round and Spindle Celled) Involving the Hyoid Bone.

Patient, George Washington White, is a resident of Richmond, Va. Colored; *æt.* 34; laborer (waiter); married. No family history of malignancy, but both parents, one grandparent, and two brothers have died of tuberculosis. Has had gonorrhœa repeatedly, but no other venereal history. A mitral insufficiency of moderate degree caused by acute articular rheumatism of four years ago, apparently.

Comes complaining of a lump, not very large,—the size of an English walnut,—beneath his chin. The skin over it is stretched tensely, and through pressure has ulcerated at one point. The larynx, which is just beneath it, seems not in-

volved, though closely related to the growth. The tumor is well away from the median line, and upon or over his right greater cornu. The man says it has grown within five months, and until within a month gave him no pain. Now it is as tender as a boil, and interferes somewhat with deglutition, which motion, through nervousness doubtless, he is impelled to repeat every few minutes of his waking time. Latterly his breathing has been distressed whenever his work has compelled hurrying.

Polyclinic pathologist's report of a small piece cut from the ulcerated point is mixed round- and spindle- celled sarcoma.

Under chloroform anæsthesia, and assisted by two members of a class of students, the first operation was done at his tenement-house in New York, he having refused to go to a hospital.

This was April 7, 1898. We chose the left, or sound, side, for reasons more fully discussed elsewhere. Except for several anomalous, large, and troublesome veins, which formed a network and needed much care and delicate handling to leave them intact,[1] the carotid excision proved uneventful. Time, fifty-five minutes. Pulse did not justify any further step; its weak character in the beginning was one reason for declining to attack the right, removing carotid and growth at one sitting. Primary union followed. Ten days later, April 17th, the other external carotid and the tumor were ablated. The veins upon this side proved less annoying, and the removal of the growth was quite bloodless, facilitating speed. It proved distinctly encapsulated, being very easily shelled out, and was attached to the greater cornu of the hyoid; whether originating from it we could not determine. One-half of this bone was sacrificed to safety. The mouth was not opened, nor was the thyro-hyoid membrane, thanks to the encapsulation.

This wound suppurated, but not badly. It was healed within a month. The patient then went back to Richmond, promising to report by mail once a month regularly. We hoped much from our positive assurance given him that otherwise the cancer would be certain to return; but after three months of obedience he skipped a month, and, finding himself still alive, ceased to write. The essayist's letter to him of renewed warn-

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[1] Upon this point, see comments upon the views, under "Operative Technique," in Chapter V.

ing and foreboding, sent a little later, came back to New York in the mail.

This case is, of course, valueless therefore, so far as the question of permanency of cure is concerned, unless White shall in the future reappear or be heard from. It seemed quite a hopeful case; that is all that can be said. But it counts as two more instances of safe enucleation of the artery under discussion.

Case XII.

Myxosarcoma of the Tonsil. Removal of Both External Carotids.

(Professor Keen's Case. Operations by Professors Keen, Da Costa, and Hearn.)

Amelia C. M., *æt.* 18, of Philadelphia, was admitted to Jefferson Hospital October 8, 1898, at the instance of Drs. J. D. McLean, W. J. Freeman, and T. S. K. Morton. Father and mother living, at ages of 45 and 48. She has always been healthy. Seven brothers and sisters living and well; one brother died of whooping-cough at 3 and one of tuberculosis at 21. Menstruation at 17. Has always been inclined to breathe through her mouth, and was treated for catarrh of throat and nose till 7 years old, but had no known trouble with the tonsil.

Two years ago she began to complain of pain in the region of the right tonsil. Her mother examined her throat and found a lump the size of a hickory-nut. The soreness soon disappeared, but the lump continued to enlarge. She was treated by erysipelas and prodigiosus toxins a year ago for seven weeks, at the Philadelphia Polyclinic Hospital, under the care of Drs. Morton and Freeman, who strongly urged immediate operation, but this was declined.

Three months ago the tumor began to grow very rapidly. On admission it occupied the right tonsillar recess, almost touching the left side, so as almost entirely to occlude the isthmus of the fauces. It extended into the tissues of the sublingual region, bulging it forward and projecting into the mouth opposite the two bicuspid teeth. The growth is a brighter red than the surrounding tissues, firm upon pressure, irregular in

outline, bleeds easily, but not profusely, and is not painful. She has not lost any weight. Heart and lungs normal.

Urine specific gravity, 1.021; and neither sugar nor albumin; urea, 1.8 per cent. Portions of the tumor had been repeatedly removed at the Polyclinic and the growth determined to be myxosarcoma.

Operation October 12, 1898. The following is Professor Keen's statement:—

"My intention was first to remove the glands; secondly, to dissect out the right external carotid (and at a later period the left external carotid), following Dawbarn's suggestion; split the cheek back to the masseter or divide the jaw and then remove, by manipulation outside and inside the mouth, the tumor.

"By the time I had made my incision and was ready to remove the glands, the tumor in the mouth so obstructed her respiration that it was perfectly clear she must have relief by immediate tracheotomy or otherwise. Accordingly, as I had access to the carotid artery and could control any serious bleeding should it occur, I placed her in the Trendelenburg position, and with forceps and scissors removed about one-half of the tumor. This gave instant relief, and the chloroform was administered thereafter without difficulty. The bleeding was very moderate. I then proceeded to remove the rest of the glands, and dissected out the external carotid from the superior thyroid to the internal maxillary. I then dissected the tissues of the neck down to the growth, and was gratified to find that the tumor had not involved these tissues farther than in the mucous membrane, apparently. In view of a possible absorbent gland in the submaxillary salivary gland, I removed the salivary gland entirely (the specimens were given to Dr. Coplin). The growth had been toward the pharynx instead of externally. Gagging the mouth open, I was now able by scissors, forceps, knife, and my finger-nail to dissect out the whole of the mass, including the mucous membrane and nearly two-thirds of the soft palate. The tumor extended downward quite to the opening of the larynx, and upward into the posterior nares, and on to the posterior wall of the pharynx nearly to the median line. The bleeding was very moderate, and was controlled by one ligature and iodoform gauze packing, which was left in the wound.

"The operation lasted nearly an hour, but at its end she was placed in bed in a very good condition. The loss of blood was about eight ounces. I was able to accomplish my purpose without either splitting the cheek or dividing the jaw.

"She made an admirable recovery after the first operation.

"On October 24, 1898, Dr. J. C. Da Costa, at my request, made an attempt to dissect out the left external carotid. No glands had ever been found in the left side before the operation, but when he cut down upon the vessels he found the glands enlarged and so adherent that the internal jugular vein was torn in attempting their removal. He then secured this vein by two ligatures and excised a portion. In searching for the external carotid he dissected the common carotid nearly down as low as the clavicle, and nearly up to the base of the skull. No trace of bifurcation appeared.

"From this she made a good recovery, though a slight infection of the wound took place. After the first operation, except one unaccountable rise of temperature on the fourth day to 102.2° F., the temperature never exceeded 100° F., but was down to the normal on the third day and remained so. She was discharged November 14th. The throat had entirely healed. The soft palate was, of course, defective, but her speech was perfectly intelligible, and much more so than before the operation, when the tumor blocked up the fauces to such an extent.

"January 12, 1899. She has gained ten pounds in weight since the operation, now weighing ninety-seven pounds. Her voice also has returned almost to the normal. No ill effects have followed the extirpation of the carotid."

(Accompanying this was the report upon Dr. Keen's extirpated growth, by Dr. Fred. J. Kalteyer of the Pathological Department of Jefferson, verifying the former diagnosis of sarcoma made at the Philadelphia Polyclinic, and describing it as of the round-celled variety.)

Appended are extracts from a letter to Dr. Keen, dated January 17, 1900, from Dr. John D. McLean, referring to the death of this patient: She died December 9, 1899, after an acute illness of only three days. Her health had been very excellent before this, attending parties, "where she was the life of the party," etc. Three days before death she developed suddenly intense pains in body, head, and legs; fever up to 104°

F., and delirium. She died "almost entirely paralyzed." . . . "My diagnosis would be rupture of a sarcomatous growth in the brain, except that there were no previous pressure symptoms. Is that correct? They refused a post-mortem."

It is also detailed how she had for a time pain and pressure symptoms, ending October 22d in a discharge of much very offensive pus from beneath her tongue on the right side. In two weeks this ceased and "the tongue was healed entirely. For about one month before her death she was as well as at any time during her entire illness."

It would seem from the description that there was in this case no recurrence at the original site, except a small one, removed by Professor Hearn's operation of March 9, 1899, whatever may be thought of the correctness of the assumption of a brain involvement of the same malignant nature, concerning which the author is, of course, not in a position to speak with certainty. And it seems a fair inference that this young lady lived much longer because of the operations of Drs. Keen, Da Costa, and Hearn than would otherwise have been at all likely: *i.e.*, than a simple extirpation of the growth would have accomplished. She died about fourteen months after the carotid and tumor excision.

Again, since no external carotid at all was found upon her left side, the condition as described being anomalous, we may well doubt whether (though Dr. Da Costa, of course, ligated all arterial branches which he saw supplying structures fed by the external carotid normally) as entire a degree of starvation upon this side was produced as could be wished; and this anomaly may therefore conceivably have a bearing upon the recurrence *in loco* upon which Dr. Hearn operated, as also upon the suspected brain metastasis.

Following is the statement of Professor Hearn as to his part in this very interesting case:—

Upon March 9, 1899, Dr. Hearn operated upon this patient, at the request of Dr. Keen, who was ill that day. There had appeared a recurrence in the posterior wall of the pharynx. This was excised down to the vertebra, and then the base was cauterized, protecting the mouth by doing the cauterization through one of Kelly's rectal tubes. (From the above description it is plain that this recurrence was a small one, promptly taken in hand; and up to the time of her death from another

cause in the following December, or nine months later, she was apparently free from a return here.)

Case XIII.

Carcinoma of the Neck.

Mrs. Hannah S., *æt.* 50; housewife; married. Sent to me by Dr. John E. Howell, of Newburgh, N. Y., where she resided. Family history negative. First noticed growth eighteen months prior to the time of her call upon me, which was early in January, 1899. This was in the form of a lump just beneath the angle of the lower jaw, on her left side. It pressed inward upon the pharynx enough to interfere somewhat with deglutition, which was also rendered painful. At the time Dr. Howell sent her to me the lump, irregularly rounded in contour, and soft, was the size of a small egg, with a few smaller, outlying nodes to be felt adjacent. Carcinoma was suspected because of the patient's age, because of an early involvement of the skin, and because of the degree of cachexia. This last had developed with extreme rapidity, and was perhaps as marked as has ever been noted by the writer. She was also emaciated and weak to a degree disproportionate to the rather small size of the growth. A piece taken from it under cocaine and examined by Dr. Jeffries, the new pathologist to the Polyclinic Hospital, proved to be a medullary carcinoma. She was admitted to the Polyclinic Hospital upon January 15, 1899, and the first operation was performed, with the help of the house staff, two days later. This consisted in ligation of the left external carotid, followed by enucleation of the growth and the enlarged lymph-nodes. There proved to be no close adhesion to the pharynx, which was hence not opened into. We did not deem it wise to attempt excision of the carotid at this time, as she was weak indeed, and would probably have died of shock but for the use to prevent its development, before she left the table, of $2\,^1/_2$ liters of very hot normal salt solution in a vein of the operation-wound. There was primary healing. She was sent home to endeavor to become built up in preparation for the strain of the next operation. Readmitted February 6, 1899, and

operated upon the next day. Excision of the right external carotid was performed, taking but fifteen minutes to do. Incidentally the essayist may add as a coincidence that her right carotid operation proved the easiest, and her left the hardest, of any of those that he has done. But the latter excision was yet to come.

Once more there was primary union; and in ten days she was sent home to Dr. Howell to try to reinvigorate. But before she had even had her second operation we noted, late in February, in a letter from Dr. Howell, that there was some return of pulsation of various branches of the ligated (left) carotid; therefore the report in March from her was not a surprise, that she noted a few lumps reappearing near the site of the first one. Because of this fact we did not dare wait as long as otherwise we should have done; and in the end of March she was readmitted. Upon April 14th, about two months after the right carotid ablation, the writer operated for the last time, excising the left external carotid, together with all the lymph-nodes discoverable. Drs. F. Lange and Frank Hartley were present to witness this operation, and would surely bear witness to its extreme difficulty. It took an hour and a quarter to accomplish. Adhesions proved numerous and dense; and at length came the misfortune, in separating one in which the bifurcation of the common carotid was buried, of tearing part of the way across the *internal* carotid, close to its origin. At once the rent in the artery was sewed with a round needle and the finest black silk; meanwhile an assistant controlled the common carotid by digital pressure, below, and the internal close to the skull in the same way. Saline infusion was freely used, also strychnine and other stimulation; but she died about ten hours later, never having come out of a state of unconsciousness. Because of this fact, plus the note upon her record that her pupils were, and continued, unequal in size after the operation, I am of opinion that a clot formed within the torn and sutured internal carotid, at this point, and that the disastrous result as to anæmia of the brain would have been no worse and no different had we simply ligated this artery or the common carotid. Wyeth puts the death-rate after ligation of the common carotid at 41 per cent.; due, in great measure, to shock from sudden cerebral anæmia; if this be survived, then to softening of the brain. This exhausted and cachectic patient

was in no fit state, at this third major operation, to survive such an accident. Unfortunately, no autopsy was permitted.

Upon a fair study of this death, it seems to the writer that the carotid excision ought not to be considered responsible. If, during a mere enucleation of an adherent lymph-node, the internal carotid were torn, a patient so emaciated, ghastly in pallor, and generally devitalized as she, would probably have died as a result, even were the external carotid not touched. Considering, too, the mass of dense adhesions, which added to the severity of the work to an enormous degree, this ought properly not to be classed in any sense as a normal carotid excision. Therefore the essayist will not tabulate it at all in compiling statistics, though he has deemed it only fair to the profession to state all the facts herein, so that all surgeons may judge.

Case XIV.

Carcinoma of the Upper Jaw.

James Degnan, Irish; laborer; *æt.* 50; single; denies venereal; family history negative. Admitted, March 10, 1899, to the City Hospital, Dr. Wherry, house surgeon. Health good until eighteen months ago, when on the left side of the nose appeared what at first seemed a pimple. This steadily increased in size, soon ulcerated, and upon admission presented a large, eroded cavity, four centimeters in its shortest measurement, involving the left half of the face from the eye down to the mouth, and extending from one to two centimeters beyond the median line. Nose nearly destroyed; also upper lip on both sides. Antrum filled with a solid mass, pushing upward the floor of the orbit. Even removal of the entire left superior maxilla would not begin to reach the confines of the growth. Great suffering, especially at night. Offensive discharge. Cachexia of extreme degree; and due to this and to prolonged habit of hard drinking, the patient's condition is a really hopeless one. Advanced atheroma, all arteries feeling like clay pipes, as to rigidity. Dr. Jeffries, pathologist of the Polyclinic (in the temporary lack of a pathologist at the City Hospital),

examined a portion of the growth and pronounced it a typical carcinoma, belonging to the epitheliomata.

Were the writer's only object to make a brilliant showing as to vital statistics, neither this nor several other cases operated upon for malignancy by this method would have been touched.

Giving him his only chance, upon March 15, 1899, the writer excised his left external carotid. The operation took but twenty minutes, and, aided by 2 liters of saline venous infusion at 120° F., he left the table in good condition. Primary union followed.

The second excision was postponed longer than usual, hoping that meanwhile his vital powers could be built up by the usual means; but it was soon evident that the cancer was getting, from the opposite side, an abundant blood-supply; and that, if anything, he was becoming weaker with each day.

Upon March 31st—sixteen days later—at 2.30 P.M., the writer excised his right external carotid. The work proved much more difficult than before, due to involvement of deep lymph-nodes, and took more than twice as long. In spite of saline intravenous infusion at the time, and continued in the form of hot enteroclysis later on, and of strychnine and other hypodermic stimulation, he succumbed to shock, dying at 11.45 P.M. the same day.

CASE XV.

Sarcoma of the Upper Jaw.

Mrs. Wolfe, German; *æt.* 56; married; housewife. Sent to the writer by Dr. Freudenthal, of this city. Admitted to Polyclinic, April 6, 1899. No family history explaining present disease; no venereal. For at least six months had a sense of aching and discomfort in the front of the face upon the right side. During January, 1899, noticed for the first time a swelling of this region. Soon the naris became entirely air-tight upon this side; and severe neuralgic pain was felt over the entire distribution of the second division of the fifth pair (right). There were occasional attacks of nose-bleed. When

the writer first saw her the tumor beneath the right orbit was the size of a small orange. By use of a sewing-needle it is found that there is partial decalcification over the front of the antrum on her right. This cavity is filled with a very soft growth, and this growth has so pressed upward as to soften and bulge the orbital floor, and cause a slight degree of exophthalmos for six weeks past.

Operation April 7, 1899, in the Polyclinic Hospital, doing a complete excision of the right external carotid, immediately followed by excision of the right superior maxillary, including half of the malar, most of the palate, and the inferior turbinated bones. The orbit seemed not involved, except as stated; and its bony floor was removed. It occurred to us to drill into the frontal sinus, as its anterior bony wall seemed by the needle test a little softened; and we were shocked to find this filled solidly with the same kind of growth. This so far as possible was gouged and curetted away; but it was recognized that radical work was being attempted too late.

By aid of 2 liters of very hot saline intravenous infusion (120° F.), given before the end of the work, she bore the operation well.

Dr. Jeffries, pathologist at the Polyclinic Hospital, examined the jaw removed, and reported that it was a small, round-celled sarcoma, possessing but very little stroma.

There was some infection of the neck-wound, and, of course, of the other, considering its nature; but both healed within a month. Three weeks after the first operation—upon April 28th—the left external carotid was excised, with primary healing. She now returned home (middle of May), but shortly reported at my office with an increase of the exophthalmos, and some external strabismus.

Upon very deep pressure in the right orbit a soft mass could be felt, partly behind, partly to the inner side of the eye, and evidently of the same malignant nature. She was at once sent to Professor Marple, who advised immediate emptying of the socket, lest the increasing strain cause blindness in the other eye. After an unfortunate period of hesitation, of a fortnight, she was readmitted to the Polyclinic Hospital, and upon June 22d the writer enucleated the right eye, and so far as could be done, by means of the curette, emptied the socket. But the sarcoma had attacked at this time the floor of the

anterior fossa of the skull, and the prognosis as to staying its onward march was hopeless. She recovered promptly and left the hospital at the end of two weeks. The writer never saw her again; but a letter by Dr. Krinke, of this city, to Dr. Freudenthal tells the fifth act of this tragedy. This stated that the same orbit became, during the summer, filled with the new growth, and that this sarcomatous mass ulcerated and caused her great pain during the final month of her life. "Emaciation, involuntary discharges from the rectum and bladder, at length coma for twelve hours, and *exitis lethalis*, January 21, 1900."

This sad case points, of course, to the hideous results of delay in calling for surgery the instant a diagnosis of malignancy is made. This delay was no fault of Dr. Freudenthal's. As the tumor probably only secondarily involved the orbit and frontal sinus, and primarily sprang from the antrum, an earlier operation would have been quite hopeful. But, as soon as operation demonstrated the involvement of the orbital walls and frontal sinus, hope of really permanent benefit was abandoned; and this must necessarily be so, because of the abundant orbital blood-supply from the ophthalmic arterial branches (coming from the *internal* carotid), anastomosing quite freely with the branches of the internal maxillary, from the external carotid, entering the orbit. This and a few lesser anastomoses in this region, mentioned in this essay under "Anatomy," make the permanent outcome of the starvation plan less favorable in and close to the orbit than elsewhere.

We are, however, not without hope that Dr. Wyeth's suggested addition to the carotid excision, which is discussed under another head, later (the plastic injection plan), may so aid the cause of permanent anæmia that even growths near the orbit may be successfully treated thereby. But we can see no way of ever applying anæmia to the contents of the orbit. For it would involve the permanent occlusions not only of both external carotids, but both internal carotids as well.

This case, as with Case XIII, that of Mrs. Hannah S., has value, for the purpose of this essay, as demonstrating yet again that carotid excision may be safely done, even upon the person of a weak woman, for she was woefully cachectic long before she presented to him her note of introduction. It is fair to assume that the partial removal of her growth *plus* the carotid

operations had some effect in prolonging her life. She died about nine months after the second carotid excision. All who saw her at the time of the original operation at our hands—April 7, 1899—were agreed in thinking that she had but a very few weeks to live unless surgery succeeded.

Case XVI.

Carcinoma of the Face.

John Sullivan, Irish; *æt.* 57; laborer. Admitted to the City Hospital on September 27, 1899 (Dr. Galloway, house surgeon; also Dr. Rinard, part of the time), with recurrent carcinoma of the left side of the face. Denies venereal history; family history negative. Has been a very heavy drinker and smoker. His general condition is weak in the extreme, and his mouth is in a foul state, partly because any attempt at cleansing greatly increases his suffering. On examination an ulcerating tumor, irregular in contour, perhaps four centimeters vertically by seven centimeters transversely, occupies the left cheek, corner of mouth, and lower lip. The mouth is contracted to a small, round hole, about capable of admitting the thumb. On the same side his neck presents large masses of diseased lymph-nodes beneath the angle of the jaw. He states that two years ago he first noticed a sore at the left angle of the mouth, where his clay pipe rested habitually. This grew, and about one year ago he was operated upon by another surgeon, who said it was cancer, and whose name he forgets. Recurrence after six months. For the past one and a half years the present mass has been increasing, and for a year has been ulcerated and discharging, especially within the lip and cheek. Much suffering, sleeplessness, emaciation, and cachexia. Presence of a small amount of sugar in his urine.

Upon October 4, 1899, the writer operated, assisted by the house surgeon, Dr. Galloway, and the rest of the staff. The right external carotid was excised. The patient received 2 $^1/_2$ liters, while still on the table, of intravenous saline infusion at 120° F. He had hardly any shock, and primary union followed.

An effort was made to build up his strength, but unsuccessfully. His stomach rejected almost all food.

October 23, 1899, was the date of the second operation, Dr. Reinard then being the house surgeon. This began with the neck incision, and it was intended to excise the left external carotid, also the masses of lymph-nodes adjacent; and then, if his strength justified it, to attack the face, doing an almost bloodless operation there, both external carotids being gone. But upon deepening the wound the plan just outlined had to be abandoned, for it was found that the involvement of the neck was hopelessly extensive. We simply tied the lower end of the left external carotid and returned him to bed. One of the lymph-nodes removed during this ligation was examined by Dr. Jeffries, pathologist to the Polyclinic Hospital, who stated that it was epithelial carcinoma.

There was, of course, now noted some shrinkage of the diseased masses; but it was certain that with his left external carotid still in place it would shortly begin to resume business by anastomoses, if he survived for even a few weeks. As it happened, his strength steadily diminished, mainly because his chronically alcoholic stomach refused nourishment; and upon the afternoon of November 8, 1899, between two and three weeks after the second operation, he died.

As a general thing, the writer thinks it wisest to operate first upon that side of the neck supplying blood to the tumor. But when, as in this case, the patient is very unintelligent and obstinate, the reverse of this plan may be deemed wiser. If his healthy-side carotid be first removed, he will necessarily see that he must remain for further work if he hopes to be cured. But if the carotid of the diseased side, and the growth (either or both) be first excised, persuasion and argument may not avail to cause him to see the wisdom of again going under the knife. A case directly in point is that of Engel among those detailed herein. (A further and stronger reason for operating upon the sound side first, when there is considerable glandular involvement upon the diseased side of the neck, will be found by referring to the history of Mr. Arthur H. Ferris in Chapter IX of this book.)

This case, of course, teaches nothing as to the permanent value of the method by anæmia, but counts in the direction of determining the safety of the procedure.

CASE XVII.

Sarcoma of Tongue, Floor of Mouth, and Right Side of Lower Jaw.

Philip Managua, admitted December 1, 1899, to the City Hospital; Dr. Child, house surgeon. Case sent to the essayist by Dr. Philip Suriani of the New York Dental School.

Patient is Italian; *æt.* 62; married; laborer; heavy smoker and drinker. No family history bearing on the case. Has had "venereal diseases"; treated in Italy many years ago. Refused details, asserting that they had no bearing upon present trouble.

About eighteen months ago he noticed a small lump on the right side of his neck. At the same time his tongue began to become sore and to grow larger. He was obliged to cease talking, because motion of it caused suffering. He was soon reduced to a semiliquid diet for the same reason. A doctor (name not remembered) cut out for him the lump on the right side of his neck, but did nothing for his mouth.

Upon admission, he is in a most deplorable state; weak and emaciated, and with distinctly atheromatous arteries in all his limbs. Apparently because of senility, it was quite difficult to get a history from him. His whole tongue, so far as the finger could feel, was involved, and it so filled the mouth that until the second day after the first carotid excision, which shrunk it, thorough examination was impossible. The floor of the mouth was ulcerated, and also the under part of the tongue on his right, and bled upon touch. There was excessive and foul salivation. The mass was adherent to the lower jaw upon the same side. A number of enlarged lymph-nodes on both sides of his neck near the angle of the mandible were noted. A small scar here, on his right, shows where apparently one was excised, as stated in his history.

A small piece of the growth was sent to the pathologist, Dr. Walter Bensel, who reported it to be a large, round-celled sarcoma.

December 7, 1899, the right external carotid was completely excised; December 19th, the same was done upon his left external carotid. All lymph-nodes to be felt were at the same time removed. Excision accomplished in thirty-five min-

utes on his right, twenty minutes on his left side. Both wounds healed by primary union, and the patient made an uneventful recovery. This was a case where we greatly feared that the patient—so old, exhausted, and diseased—would die upon the table. The writer attributes the outcome largely to the use, at each operation, of 2 liters of saline, intravenous infusion, maintained steadily at a temperature of 120° F. when entering the blood. This was begun by Dr. Child while the operation was still in progress, and was completed in about twenty minutes.

The patient was discharged from the hospital three weeks after the second excision. The improvement was very striking in all respects. The essayist has seen him at his office twice since then, and the growth is still shrinking. It is now about half its size when he was operated upon. The tongue is still so bound down that he can move it but little, but is devoid of pain. He can eat solid food, and is much stronger. He is one of five patients all apparently cured,—*i.e.*, with their malignant disease permanently held in check,—all of them being sarcomata, exhibited in March, 1900, by the writer at a stated meeting of the New York Surgical Society. It is far too early as yet, however, to claim anything positive in this man's case. It simply still looks hopeful, in spite of a most ugly and discouraging condition prior to the carotid excisions. He, however, certainly counts two instances toward the settlement of the question of comparative danger of the operation for starvation.

He was last seen, still in the condition last described above, about two months ago, by the essayist. That was in July, 1901.[1]

Case XVIII.

Sarcoma of Lower Jaw, with Extension into Floor of Mouth and Tongue.

Case sent to the essayist by Dr. Philip Suriani, of the New York Dental School. City Hospital; Dr. Child, house surgeon.

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[1] In March, 1903, an endeavor to ascertain the subsequent history and the present dwelling-place of this patient has failed.

Louis Giolito, an Italian, admitted December 7, 1899; *æt.* 64; married; shoemaker. No family history, nor venereal, bearing on the disease. Immoderate use of tobacco, always with a clay pipe. Alcohol moderately. Always healthy until about four months ago, when he began to have pain in the right side of the body of his lower jaw. His teeth became loose and he had several of them drawn, thinking the pain was due to them, but without relief. Later, involvement of the floor of the mouth behind the symphysis menti, and then of the tongue, which grew rapidly and became fixed. Much suffering.

Upon admission the mouth was in a most foul state and tongue greatly enlarged, hard, exquisitely painful, and ulcerated beneath, as also is the floor of the mouth; and the lower jaw is thickened, and is soft and decalcified as to its alveolar process, upon using the needle test, from the last molar tooth on his right to the second bicuspid on his left. The whole region involved bled severely upon touch. A small piece was excised, and Dr. Walter Bensel, pathologist to the City Hospital, reported large, round-celled sarcoma, subperiosteal in origin.

Upon December 9th the right external carotid was excised in twenty minutes. The wound was slightly infected, but the patient made an uneventful recovery in two weeks. At the same sitting the softened portion of the alveolus was gouged away. Both operations together took forty minutes to perform.

Upon January 6, 1900, the left external carotid was excised, and at this session the inferior dental artery, above its mylo-hyoid branch, was ligated, and a piece of inferior dental nerve excised; this being done upon both sides of the lower jaw. This session required an hour and a quarter. Primary union followed.

Upon leaving the hospital, at the end of January, 1900, great improvement was manifest, and this still continues. The growth has shrunken to about one-fourth of its size upon admission. The ulceration has healed, except over a small bony area, which also is slowly lessening; and pain and salivation have ceased. His general health is much better also. (This report was written in March, 1900.)

This was one of the cases exhibited by the essayist at the meeting in March, 1900, of the New York Surgical Society. All of these were sarcomata. The interval *post operationem*

is, of course, still too short for stating definitive results, but the case looks hopeful—surprisingly so, considering the extent of the involvement and the variety and place of origin of the malignant disease. As stated under the heading of one or two cases of this type, in our earlier histories, in this list, authorities were agreed that subperiosteal sarcoma of the lower jaw (not of the giant-celled type) is almost invariably fatal, with or without extirpation of the growth.

The patient was last heard from six months ago (on about April 1, 1901). A determined effort was made to trace his whereabouts. A letter had been returned by the mail; but accompanied by an interpreter the Italian colony in the huge tenement in which he had lived was visited and interviewed family by family. At length from the people there who had taken the rental of his room off of his hands, it was learned that in April, 1901, he was well; that is, had no return of growth in his tumor; and had then sailed for Italy, intending not to return. Address unknown to them.

The case consequently must be reckoned only as a hopeful one; and as twice more instancing the comparative safety, even in old age, of external carotid excisions.

Case XIX.

Carcinoma of Tongue and Floor of Mouth.

John Schinirring, admitted December 22, 1899, to the City Hospital; Dr. Child, house surgeon.

Patient is American; *æt.* 53; clerk; married; never used alcohol nor tobacco; denies venereal and tubercular disease. Family history has no bearing on present condition. Healthy all his life. Three months before admission the patient had much suffering at the inner side of his lower jaw upon his right, which he attributed to toothache, and had four sound teeth drawn without relief. Next noticed tongue rapidly enlarging, with increase of pain, until any motion of this organ caused agony; and he was obliged to keep silent and live on liquid and semiliquid foods. His sister gives us this history. At this time even deglutition is difficult, from the extreme

size of the growth, as well as from the pain it causes. Much stomatitis, with foul salivation, and all the remaining teeth loosened. His tongue bleeds, also the floor of the mouth, upon touch. He is much emaciated and hardly strong enough to stand alone, and has a marked cachectic pallor. His family doctor informed the sister that he cannot possibly live a month.

A small portion of the tongue was sent to Dr. Walter Bensel, pathologist, who reported typical epithelioma. At one of the excisions of the carotids a large lymph-node from the neck near the angle of the jaw was also sent him, with the same result.

This patient's operation proved unusually interesting. The first performed was upon December 26th, under chloroform anæsthesia. Incision made along the course of the right external carotid. While the wound was being deepened and before that vessel had been exposed, the patient's breathing became bad: due to farther swelling of the tongue, already almost filling the mouth, and pressing upon the larynx and pharynx, before the operation had begun. In an attempt to draw forward the tongue by a blunt retractor hooked behind it (the only possible way in this case, with the front part bound solidly to the floor of the mouth) a very sharp and sudden bleeding from some unknown part of this ulcerating organ was started; and although the head was instantly lowered and turned sharply to one side, and careful sponging used, blood must have entered the larynx and clotted, for the patient promptly became cyanotic, and death was imminent from suffocation. Without delay laryngotomy was performed, taking but a few seconds. This gave instant relief. The patient's weakness prevented our going further at this time. A saline intravenous infusion was used, of 2000 cubic centimeters, at 120° F. on entering the blood, and he was removed to bed. The wound over the carotid, which had unfortunately been fouled by fluids running from the patient's mouth, was but partly closed, and was wet-dressed with weak bichloride gauze. It suppurated, but only to a slight degree.

Upon December 30th the left external carotid was excised, the operation being without incident, and requiring but eighteen minutes. This wound proved slightly infected, but healed without incident.

January 24, 1900, the right external carotid was removed,

together with a number of enlarged lymph-nodes. By this date the wound of December 26th had healed, and the line of its scar was followed in exposing the vessels. (Saline intravenous infusion at 120° F., 2 liters used, as also during the previous excision.) The patient was returned to his ward in good condition. During both excisions the anæsthetic—ether—was administered through his laryngotomy tube, which was removed after the second excision; and this opening then healed without event.

Upon January 31st, or a week after the final operation, the patient developed erysipelas in his first excision wound, now soundly healed. He was moved to the isolation pavilion. The case proved not a severe one, running a simple course. Upon discharge he has repeatedly reported to the writer. The condition of his cancer is strikingly ameliorated. The tongue has become about one-fourth of its former size. It is about normal in its dimensions now. Being firmly bound down still, and hence nearly immovable, his speech is indistinct, but painless; and he can enjoy solid food. There is no ulceration, and his general health is infinitely improved.

In March, 1900, this patient, as also several cases of sarcoma minus their external carotids, was exhibited at the regular meeting of the New York Surgical Society. The report just read was entered in the essayist's note-book at that time.

Although asked to report regularly once a month, nothing was heard of this man from that time until the following winter. During December, 1900, he was readmitted at the City Hospital, the writer being then upon duty there. The patient was found far advanced with a rapidly developing pulmonary tuberculosis involving both apices; and had become emaciated, was suffering from cough, night-sweats, and a moderate degree of hectic fever, etc. Tubercle bacilli were found in his sputum by Dr. Ottley, an interne in the surgical service. His mouth condition remained about as when last reported. He was unable, through immobilization of his tongue, to speak at all distinctly; but this organ continued small and painless, and free from the ulcerations originally present.

When Schinirring had been in the ward for about two months, with progressive loss of strength, he developed upon the right side of his neck, below the angle of the jaw, a swell-

ing which soon became deeply fluctuant. The aspirating needle proved the contents to be pus. At the same time his mouth and tongue became quite sore and the saliva ropy and offensive. Attributing the mouth conditions to sepsis from this abscess (though possibly cause and effect were in this assumption reversed) it was hoped that, with opening, curettage of the abscess-walls, and drainage, the stomatitis and glossitis might soon subside. Accordingly we operated, upon February 1, 1901. He bore the anæsthetic (ether) badly, and the affair was hurried through. In spite of every care he succumbed to shock within twelve hours.

Dr. Ottley made the autopsy, removing portions of the cancer of the tongue, also of the tubercular deposits in the lungs. He satisfied himself as to both of these conditions by microscopical examination. Also the essayist sent specimens of both tissues to Dr. Jeffries, pathologist to the Polyclinic Hospital, asking the courtesy of his opinion, as just at that interval we were without the services of a pathologist at the City Hospital. Dr. Jeffries reported that the tongue presented evidence of ordinary epithelioma, with no degenerative changes. (The writer had rather expected that the great shrinkage and prolonged inaction of the growth would have been accompanied by such changes; so this was somewhat of a surprise.) Also that tubercular disease had been present. And Dr. Jeffries added that it was the only instance in his experience where a cancerous subject had also developed consumption; that there seems to be an antagonism between these diseases.

This was a new thought to the writer; and it opens a field for speculation and experiment as to the possible effects of some form of tuberculin upon malignant (cancerous) tumors; or, conversely, the possible results of treating tuberculous subjects by hypodermics of sterilized and filtered cancer-juices.[1]

This patient's case is, of course, entirely inconclusive as

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[1] Some two years or so after this was written the author met a second case in which, in a carcinomatous subject, consumption developed, killing him (see the history of Thomas Clifton in the final chapter). Upon reflection, Dr. Jeffries's opinion seems susceptible of a simpler explanation than the one he suggests, namely: that the age at which tuberculosis ends the life of the enormous majority of its victims is so early that few, indeed, reach the period in the forties, or older, at which cancer commonly makes its appearance.

to the final result of the starvation treatment upon his cancer had he lived. Plainly, it was of enormous advantage to him, and his life was about a year longer than otherwise might have been expected. But the essayist deems it highly probable that, had he survived the final operation, long before the three-year limit of safety active recurrence would have appeared and carried him off. For in no patient as yet has this treatment proved a permanent cure of carcinoma, though the reverse can, we think, be claimed as to sarcoma in some instances. Schinirring's case also shows once again that even in a case of extreme cachexia it is possible to excise both external carotids without greatly jeoparding life thereby.

CASES XX AND XXI.

Carcinoma of the Mouth, etc.

(Two cases by Dr. Willy Meyer, of New York.)

Dr. Meyer writes as follows:—

May 27, 1901.

MY DEAR DOCTOR:

Your kind favor of the 16th duly came to hand. In reply I herewith take pleasure in sending you a brief report regarding the two patients with malignant growths, operated upon with the help of extirpation of the external carotids:—

Case I.—Male, *æt.* 49, with ulcerating cancer of the base of the tongue, including floor of the mouth. The disease had existed for ten months.

The man suffered terribly, especially on account of difficulty and pain in swallowing, continuous salivation, and *fœtor ex ore.* The case seemed almost inoperable; yet, yielding to his request, radical operation was resorted to. The same was done April 16, 1900. Following your advice, I decided to first extirpate the carotid on the non-affected side, fearing, too, that the patient would not submit to this interference later. The operation was troublesome on account of the patient's difficulty in breathing during anæsthesia. The tongue was perforated with silk thread and forcibly pulled out by this means. Wound healed by primary union, but marked glossitis with septic fever and increased *fœtor ex ore* followed. As last resort: Radical operation in three steps: April 23d—first, inferior tracheotomy, followed by extirpation of

glands on right side; second, extirpation of right external carotid with all its branches; third, Kocher's extirpation of tongue.

The neoplasm reached very far down, involving the hyoid bone, which also was removed. The patient did not rally, but died twenty-six hours after operation. Pathological diagnosis of tumor: carcinoma. Autopsy: œdema of lungs; hard, infiltrated glands, surrounding the trachea, entered far down into thorax.[1]

Case II.—Male; *æt.* 50. Inoperable, ulcerating epithelioma of the right tonsil, right half of soft palate, base of tongue, floor of mouth, cheek, and mandible. According to the history, the first symptoms were noted two and one-half months ago: ulceration, with pain in swallowing; treated by means of potassium iodate and local application of nitrate of silver. Very soon glandular swelling appeared. Patient was an inveterate smoker.

Carotid starvation plan proposed and adopted. First operation on diseased side, including thorough extirpation of glands, May 31, 1900; drainage in middle of wound down to floor of mouth.

June 18, 1900. Extirpation of external carotid on opposite side. Primary union. The canal of the drainage tube on the right side proved to be very obstinate, and in spite of most careful treatment did not show any tendency to heal, but became invaded by the disease. I wish to add that on both sides the main trunk of the external carotid, before dividing into temporal and internal maxillary, was ligated. It proved absolutely impossible to bring the bifurcation into view. As far as the ligation of the branches is concerned, I am absolutely positive that every single one was thoroughly isolated, ligated, and cut through.

To my sincere regret I was unable, in this particular case, to note any diminution in size of the growth. The patient succumbed six months later.

These, my dear doctor, are the only two cases I have so far operated upon. I have, however, been so much impressed by your plan that I shall surely continue to follow it wherever I find it indicated.

Believe me,

Sincerely yours,

WILLY MEYER.

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[1] The essayist submits that in fairness we cannot consider the carotid excision alone responsible for the death of this subject. The Kocher operation of excision of the tongue is a severe thing in itself. Again, there were formidable glands excised at this operation, enough so to be mentioned as a separate step. There was also extirpation of the entire hyoid bone. We shall therefore not class this carotid excision as responsible for the death; and the more justly so since the carotid excision successfully borne upon his other side proves him capable of supporting that operation when done alone.

Case XXII.

Epithelioma of the Floor of the Mouth.

(Case of Dr. J. A. Blake.)

Patient, P. Sherry, *æt.* 55, admitted July 17, 1900, to Roosevelt Hospital, New York City. Family history negative. No venereal. Five months ago mouth began to smart each time that solid food was masticated. A dentist removed two lower teeth, and a soothing mouth-wash was prescribed by his physician. Two months ago two more lower teeth were removed. Three weeks later lumps were noted in the right side of the neck, near angle of lower jaw. Now the gums became sore, and indurations appeared in the floor of the mouth upon his right, bleeding spontaneously. Microscopical diagnosis made by a competent pathologist was epithelioma.

Operation, by Dr. Blake, July 19, 1900; excision of external carotid, right side; uneventful operation except for large glands removed; smooth recovery.

Second excision July 31, 1900, uneventful; and patient went on to recovery from his wound, being discharged from hospital August 11, 1900.

Dr. Blake, in September, 1901, stated he thought, but was not certain, this patient died three or four months later.

Case XXIII.

Angioma (?) of the Face.

(Case of Dr. J. A. Blake, of New York.)

Admitted to St. Luke's Hospital, New York City, September 7, 1899. Miss Isabelle H. Family history and past history negative.

Personal history: Child, *æt.* 7. Mother first noticed a little swelling on left cheek four months ago. Baby fell out of bed shortly before tumor appeared. Tumor grew slowly for two months, but during the past two months it has grown faster. Dilated veins began to appear three months ago.

Present examination: Child fairly well nourished. Skin and mucous membranes good color. All organs normal. Left cheek from zygomatic process to neck and from median line anteriorly to just behind lobe of ear is occupied by a swelling, soft in consistency, easily compressible, and by pressure reduced in size. Over the lower part of the swelling there are numerous dilated blood-vessels, both veins and capillaries.

In the mucous membrane of the mouth lining the left cheek are also a few dilated vessels. The upper part of tumor beneath zygoma is firmer in consistence and seems like a soft lipoma. The lower part, especially the part bulging into the neck, seems more like angioma. Skin normal except for dilated vessels.

Operation by Dr. Blake, August 10, 1900. Excision of the left external carotid (in the usual way heretofore described). This description is omitted for economy of space.

The little patient did well, and upon August 22, 1900, Dr. Blake excised the right external carotid. This also was safely accomplished. The baby was discharged October 15th. Entry on book was: "cured."

The official pathologist of the hospital examined a specimen of the growth, pronouncing it sarcoma; variety, not stated, unfortunately. (During an interregnum of pathologists we are told that many pathological memoranda were lost.) In September, 1901, Dr. Blake stated that this child was still alive and well.[1]

Case XXIV.

Carcinoma of Lower Jaw, Face, Neck, Floor of Mouth, and Tongue.

Patient, William Semkin, is English; *æt.* 52; married. History, family and otherwise, has no bearing upon malig-

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[1] In a letter dated March 27, 1903, Dr. Blake writes: "I have been unable to keep track of the little patient. . . . I think the diagnosis of sarcoma in her case incorrect, and that her tumor was of that variety which some pathologists report upon as sarcoma and others as simple angioma. . . . The operation was done to limit the supply of blood to the angioma, and not with the idea of curing a sarcoma."

nancy. Admitted September 17, 1900, at City Hospital; Dr. Munson, house surgeon. In May, 1900, had facial erysipelas, and when cured swollen glands resulting therefrom were removed from his neck, right side, in the Post-graduate Hospital of New York City. Present trouble began last March, with a swelling of the right side (body) of lower jaw, within the mouth. This extended within a month into the floor of the mouth, and also the side of the tongue; and motion of the tongue in speaking and deglutition became agonizing about a month prior to admission.

Meantime the tumor had progressed outwardly also, and a large, ulcerating, fungous mass presents upon admission. This is ten centimeters vertically by half this transversely, its center being about opposite the point where the facial artery first touches the lower jaw. The mass bleeds frequently even without contact. At this time, too, the floor of the mouth upon his right is found lifted by the growth to a level with the crowns of his lower teeth. The saliva is very fœtid. The man has been sleeping badly, from suffering, and is miserably cachectic. Upon both sides of the neck enlarged lymph-nodes in masses can be felt. Upon his right a scar shows where, beneath the body of the jaw, the glands mentioned in his history were excised.

This case was sent to us to die, by his friends. It was a remote chance of relief that we took in trying carotid excision. Of course, radical work as to his disease was utterly hopeless. Examination by our pathologist of a specimen cut from the granulating mass shows typical epithelioma.

Operation by the essayist upon October 2, 1900. Patient took ether very poorly. Chloroform substituted without improvement. Mechanical obstruction to respiration from swelling of base of tongue. Laryngotomy performed as the first step. Complete excision of the left external carotid followed immediately. This occupied three-fourths of an hour. Unexpected difficulty due to quantities of large, adherent, and cheesy lymph-nodes (this was upon the "sound" side; whether these nodes were carcinomatous was not ascertained, by an oversight of the house surgeon, though the order was given at the end of the operation).

During the gland-removal a small tear was made into the deep jugular vein. Two small artery clamps were left closing

this, and removed after forty-eight hours. Two liters of saline intravenous infusion, at a temperature of 120° F., were used while the operation was nearing completion. By aid of this and free use of strychnine by needle, patient was removed to bed in a better condition than we had dared to hope.

This wound healed slowly, and was not yet entirely well, though very nearly so, when the operation of external carotid excision was attempted upon his right side: upon October 19, 1900. Meantime an attempt, quite futile as it proved, had been made to build up his strength in preparation.

This second excision was not accomplished. Great masses of cancerous glands overlying the artery were found to be even more adherent to important structures than usual. The wall of the internal jugular vein was adherent to them and was itself diseased. This vein was exposed high up with much difficulty, and low down, ligated twice, and the intervening portion of about a finger's length excised together with the glands. This had taken over a half-hour to do. The patient's respiration and heart-action became very bad immediately after the internal jugular was tied—doubtless from its effect upon the cerebral circulation. It is quite conceivable, too, that its fellow upon the left had become wholly obstructed by clot at the point where its side had been clamped, upon October 2d, in which case a very serious degree of venous congestion within the skull must have developed, if both these great veins were obstructed. Hot saline infusion and every other attempt to revive the man failed. He slowly sank from shock, his pulse running up to 160 or more; and he died about twelve hours later, upon October 20, 1900. Autopsy was refused by his friends, unfortunately.

This case counts only as a successful single instance of excision of an external carotid in a very cachectic individual. Had the second excision been carried out with success also, it was contemplated at a period some weeks or months later to remove as much of the fungous mass and softened and caseously degenerated bone as the Volkmann spoon would permit. A painful experience has taught the essayist the unwisdom of attempting too much in the way of operation at one sitting. It is a very common mistake of surgeons—and in justice to this new procedure of carotid excision we hope that whenever it is attempted the operator will do nothing further that day except

to remove any diseased glands in the field of the incision. It is obvious that, when instead the surgeon proceeds to operate at the same sitting upon the malignant tumor, if death follows it becomes impossible to judge which factor is to blame for it. In a few instances the writer has himself both excised the artery and done work upon the tumor at one and the same operation, but intends not to do so hereafter, unless in the presence of some strong reason to the contrary.

Cases XXV and XXVI.

(Cases of Dr. William P. Nicolson, of Atlanta, Ga.)

Dr. William P. Nicolson, Professor of Anatomy in the Medico-Chirurgical College of Atlanta, Georgia, reported at the Thirteenth Annual Meeting of the Southern Surgical and Gynæcological Association held at Atlanta, November 13 to 15, 1900, the following two cases successfully operated upon by excision of both external carotid arteries—thus making four operations for sarcoma, variety not stated.

"Case I. *Sarcoma of the Nose.*—W. A. M., male; *æt.* 30. Referred to me by Drs. A. W. Calhoun and W. E. Campbell. Six months previous to the time I saw him he suffered apparently from a polypus of the nose, upon the right side, which was removed by the ordinary operation, and recurred in a few months. It was removed subsequently several times, each operation being followed by a rapid reappearance of the tumor. When I saw him about three weeks before operation the nose was completely obstructed and the pain from the constant and increasing pressure was very great.

"Arrangements at this time were made for him to be operated upon within a few days, but in the meantime he fell into the hands of another physician, who made daily application to the growth through the nostril, with the result of causing the most rapid increase in its size. When seen about three weeks subsequently his aspect had undergone a remarkable change. The growth was pressing back under the orbit, forcing the right eye against the supra-orbital ridge and out of the outer canthus. The side of the nose at this point was

also bulging out decidedly. Upon the left side of the forehead there was a prominent tumor, which was of a resilient character. The suffering from the pressure was very severe and the growth in the nose was beginning to break down, as evidenced by the previous discharge from the nostrils.

"On October 3, 1900, the right external carotid artery was excised, all of its branches tied off, and its trunks in practically its entire extent. Soon after reacting from the operation the patient expressed himself as being almost immediately relieved of much of the feeling of pressure and requiring less morphine to control the pain.

"Two days after the operation the enlargement upon the forehead broke down and was opened, discharging a large amount of pus and revealing the fact that the bone was bare at this point. Either from the pus that unavoidably got into the left eye or from infection from the discharge from the nose, a severe palpebral ophthalmia was set up in the left eye and subsequently in the right.

"The suffering and swelling from this and from the abscess obscured, to a large extent, any change that might have taken place as the result of the operation at this time, but it was evident that all increase had been checked, with probably some diminution. Two weeks after the first operation the carotid upon the left side was also excised, with a decided improvement of the condition, and two weeks subsequently he left for his home in the country.

"It was evident that the increase of the growth had been stopped, and the contour of the face had changed sufficiently to lead to the belief that there had been some positive decrease. Practically all pain had been relieved except that due to the abscess of the forehead, but the future only can demonstrate how permanent these changes may be.

"CASE II. *Inoperable Sarcoma of the Upper Jaw.*—W. C., mulatto; male; *æt.* 23. Referred by Dr. Thompson, of Alabama.

"An enlargement of the left upper jaw began three months previous to the time I saw him, and the growth was so rapid that his physician, thinking it was an abscess, made an incision into the most prominent part, but found no pus or breaking down of tissues. He then made a diagnosis of rapidly growing sarcoma. At the time that I saw him the tumor involved the

whole of the left upper jaw, pushing up the floor of the orbit until the eyeball was partly extruded from its socket and extending well up on the malar bone. The nose was pushed over to the right, beyond the median line, and the left nostril completely and the right partially obstructed. The roof of the mouth was forced down upon the left side and the enlargement extended well beyond the median line. The skin over the whole tumor was adherent. As several surgeons who had seen the case had pronounced it ineradicable, he was advised to undergo the operation for excision of the external carotids as the only thing left to exercise any control over the growth. To this he readily assented, and on October 10, 1900, the operation was done before the class of the Atlanta College of Physicians and Surgeons, the left external being excised first *on account of the growth being upon that side.*[1] The operation was difficult because of quite a high division of the left common carotid, and was complicated by an unfortunate accident. The vessel was tied at two points, and when it was secured between ligatures the proximal end in some way slipped out of the ligature, causing a severe hæmorrhage, which rendered it necessary to tie it quite near to the bifurcation. The progress of the case was perfectly satisfactory until the morning of the seventh day, when there occurred a profuse secondary hæmorrhage, *from the cutting through of the ligature.*[2] Death must have inevitably resulted speedily but for the timely arrival of my assistant, Dr. Reid, who promptly reopened the wound, and, failing to secure the vessel with forceps, made direct pressure upon it with his finger until my arrival, when the common carotid was tied one inch below the bifurcation. Though practically exsanguinated, the patient reacted well under the employment of saline enemata. This accident rendered it necessary to postpone the second operation until the fourth week. The right external carotid was excised on November 8th, and the condition of the patient is perfectly satisfactory at this time.

"As a result of the first operation, the feeling of pressure in the growth was immediately relieved, and subsequently the

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[1] Italics ours. Note, on the contrary, comments accompanying Cases XXXIX and XL *et al.* Also case of A. H. Ferris in Chapter IX.

[2] Italics by the essayist.

nose upon that side of the tumor admitted the passage of air in respiration. The skin, which was formerly closely adherent to the tumor, is now movable, and the patient feels much more comfortable in every respect."

Since a secondary hæmorrhage is an occurrence unknown to the writer personally in any of his cases of this operation, is it not conceivable that in this patient it would not have occurred had the ligation been made so gently as to avoid all possibility of rupturing any of the tunics? The writer is convinced that, though almost all surgeons adhere *in theory* to the modern teaching that we should avoid rupturing a tunic, and should depend upon cellular activity at and near the ligature to obstruct permanently the arterial lumen, nevertheless *practically* they tie very tightly, risking breaking one or two of the tunics; and do so fearing that otherwise the hammering heart will roll or push the ligature off of the vessel-end. And this probably explains certain cases of secondary hæmorrhage.

In this dilemma the author has for years advised and used in major amputations, and latterly in his carotid work too, *tying by aid of a semicircular needle and holder.* In this way we may tie as gently as we please, for the purse-string suture passed some distance proximal to the vessel-end and caught in the tissues about the sheath cannot slip off. (See the author's article upon this topic in the *Annals of Surgery* for January, 1903.)

Case XXVII.

Recurrent Carcinoma of Tongue, Jaw, and Side of Face.

Patient, John Gibbons, is Irish; *æt.* 61; married; carpenter. Family history unimportant. Denies venereal. Admitted September 28, 1900, at City Hospital; Dr. O'Brien, acting house surgeon.

Present illness began in May, 1898, with a sore throat.

This continued for a year, gradually getting worse. He then went to Bellevue, Out-patient Department, where he was told his tonsils were enlarged and a gargle prescribed. This did not help him, and he was treated subsequently at St. Vincent's Hospital, Out-patient Department; same diagnosis, but no relief afforded. Next he was admitted to the General Memorial Hospital, New York, where upon December 27, 1899, the left half of his tongue was removed. Some unknown additional operation was there performed upon the left side of his face near the angle of the jaw, upon February 3, 1900. He left there May 3, 1900, with the latter wound still unhealed. One month later it freely began to discharge purulent material, and occasionally to bleed. He then, too, began to have sharp pains in both ears and in the region of the wound and in his mouth. Sleep has been bad for several months, and he is cachectic and emaciated to an extreme degree.

Upon admission the remaining half of his tongue is found cancerous, bound to the floor of the mouth, and ulcerating. A large fungous mass—about a finger long vertically and two fingers wide—exists over the ramus of the jaw upon his left. The lower jaw-bone is soft to the needle test everywhere except the right ramus; upon his left in spots it is as soft as cheese.

Upon both sides of the neck and beneath the body of the jaw enlarged lymph-nodes can be felt. A piece of the raw surface fungus, like upon his left, was examined by Dr. Jeffries, at the writer's request, who reported it to be epithelioma.

Fearing certain death upon the table, a strong effort was made to build him up by tonics, without much use, except that sleep produced by gr. xx-xxx doses of trional nightly and some morphine for pain gave him rest. To this extent he was fitted for the strain of operation by the middle of October, and October 19, 1900, we operated upon his left, excising the external carotid with great difficulty because of the masses of glands needing removal before this could be done. Operation took fifty minutes. During the last twenty of these he received 2 $^1/_2$ liters of saline infusion in the right median cephalic vein, at a temperature of 125° F., Dr. O'Brien attending to this step; also free use of strychnine. The man left the table in remarkably good condition because of these means. The wound suppurated and was very slow in healing. Meantime, as the fungous mass and also the remainder of the tongue had

distinctly grown a little smaller, though not much, the writer was willing to wait before attacking the carotid upon his right, hoping for a further gain in general health. This was probably a grave mistake. Early in January, 1901, a rapidly developed swelling appeared in the neck beneath the body of the jaw upon his right. There were rigors and fever, and when the writer's attention was called to the condition by the house surgeon deep fluctuation was noticeable. Without delay, other work being postponed, Gibbons was operated upon on January 6, 1901. Not alone one, but several abscess-cavities containing peculiarly offensive pus were found and evacuated. (Some of this was examined next day by, I think, Dr. Ottley, of the resident staff, who found a large variety of micro-organisms, streptococci included. Probably the saliva was the source.) Very unfortunately one of the largest of these pockets burst, during the work, into the mouth; and the next instant the patient inhaled deeply and nearly strangled with the pus. The fluid, mixed with some blood, could be heard within his larynx and trachea bubbling during respiration. Swabbing was, of course, done at once and thoroughly; irrigation of the pharynx performed with the face turned aside and lowered. But the condition, to the writer's mind, justified as the only right measure a prompt laryngotomy. This was done, the air-passage being opened within about five minutes after the pus had been inhaled. At once he coughed, bringing out thick pus from the trachea, identical in odor and appearance with that which had been found in the pus-cavities. With absorbent cotton carefully wound about long, slender applicators the larynx and trachea were as thoroughly, and of course gently, wiped as possible. With the patient for a couple of minutes nearly inverted, irrigation was next practiced from the laryngotomy wound through the larynx, which was flushed, and so out of the mouth and nose. His emptied pus-pockets were rubbed with aristol, and a gentle packing of aristol gauze was used. He was returned to his ward in fair condition for so weak and cachectic a man.

But the writer, addressing the house staff, there and then expressed the belief that a septic pneumonia could not help but be developed, as it was very unlikely that none of the pus had entered the bronchial tubes. This, to my deep regret, proved true; and with a typical pneumonia, involving a

portion, chiefly the upper part, of both lungs, he died one week later, upon January 17, 1901. We were only surprised that he did not die of it in less than seven days. Autopsy was refused.

This case counts simply for the purposes of this essay as one more instance of the safety of carotid excision even in the weak; though its history teaches certain other lessons of value.

Case XXVIII.

Sarcoma of the Upper Jaw.

(Case of Dr. Howard Lilienthal, of New York.)

The following letter from Dr. Lilienthal is given *verbatim*:—

My dear Doctor:

Some time ago I received a letter from you inquiring about a patient upon whom I had performed the operation devised by you for the starvation of inoperable malignant growths of the face. I have just come upon an abstract of the history which is to be published in the report of Mt. Sinai Hospital. I give you a copy in the following:—

"Endothelial sarcoma of the superior maxilla. Infection and suppuration. Operation. Death.

"Louis E., *æt.* 64, was admitted on the 14th of November, 1900, suffering from an infected tumor of the right upper jaw. The patient was exceedingly feeble and septic. Operations for drainage were at once performed, and on November 24th, after receiving the pathological report upon a portion of the growth which had been excised, the patient was chloroformed and both external carotids were excised as far as the internal maxillary branches. The patient suffered from severe shock after the operation, from which he did not recover, dying within twelve hours. There had been remarkably little hæmorrhage."

Very truly yours,

Howard Lilienthal.

February 24, 1901.

The essayist can but express regret that in a case "exceedingly feeble and septic" so serious a measure as complete excision of the external carotid should have been performed upon both sides at one and the same sitting. Even in a strong patient, free from sepsis and cachexia, the essayist has never dared to attempt such a thing; and, were he to do so, would

naturally have some fear that death from shock might follow. At least the risk of it would be great. This case must now be entered upon the statistics of fatality of this new procedure, to its detriment; to that extent deterring other surgeons who may contemplate trying it upon their patients, and who judge of safety mainly by published percentages of death or recovery.

We feel sure that Dr. Lilienthal's own present judgment would agree with our own in this regard; and are well assured that his known ability as an operator will render his future statistics second to none.

Case XXIX.

Epithelial Cancer of the Face.

(Case by Dr. John F. Erdmann, of New York.)

Patient, X, male; married; *æt.* 44; theatrical agent. Growth in right cheek extending to angle of mouth, and in apparent extent of ulcerated surface about as large as a twenty-five cent piece. Its development was exceedingly rapid. Pathological examination by a Philadelphia pathologist (name not given) proved to be epithelioma. Extirpation of cancer urged. Patient refused the mutilation; but agreed to accept carotid-starvation plan.

Right side operated upon in the beginning of December, 1900. Left side operated upon at the end of the second week of January, 1901. The first operation was complicated by the extirpation of a mass of diseased glands, but did well. The second carotid excision was followed by suppuration and sloughing of the entire wound. About the third week afterward there occurred a secondary hæmorrhage in this sloughing wound from the internal carotid. For this the common carotid was ligated, with recovery.

Upon the right, where the cancerous masses of glands had been, infiltration with the disease and ulceration appeared finally after a few months. But at first the growth upon the face was distinctly shrunken, and so remained for from four to six weeks. After this period it began to grow again. In the fourth month after the second carotid excision his ulcerated

growth became infected with erysipelas. He was treated in the erysipelas pavilion at Bellevue; but it proved the most ugly case of this disease that Dr. Erdmann ever saw. Death in consequence between the third and fourth day. The above notes, Dr. Erdmann explains, are deficient in detail because the full history is mislaid.

He adds that the operations as performed by him differed from the essayist's, as follows: "In the case mentioned I ligated both the external carotids at their origin, and each and every individual branch, but did not cut out the main trunk; feeling that my ligatures accomplished the same as the method you advocate. There was no other reason for not removing the trunk of the external carotid, and, in fact, no good reason for retaining a totally dead or impervious channel."

The author agrees in opinion with the remark of Dr. Erdmann last quoted. It is plain, however, that, for the purpose of the statistics of mortality of the operation of carotid excision, these operations by Dr. Erdmann may fairly be considered to be in the list now being compiled, and should rank as such excisions, with recovery, but as failures in controlling the malignant disease for more than a few weeks.

Case XXX.

Epithelioma of the Tongue.

(Case of Dr. George E. Brewer, of New York.)

Patient, M. Quinn; *æt.* 41; admitted to Roosevelt Hospital, December 12, 1900. Family history negative. No specific history; moderate drinker; smokes and chews to excess. Has always had bad teeth. Present trouble began five months ago with an ulcer along left side of the tongue, the size of a finger-nail. It was cauterized by a doctor with alum, and it became much smaller and healed, but left an indurated lump. Six weeks ago this hardened area increased and began to spread in all directions, and about the same time he noticed a commencing lump below the angle of the jaw upon the same side. Both have grown larger since then. Has had at times a slight stinging in the tongue, especially while eating, but no

actual pain. Claims no loss of flesh nor strength. Speech slightly indistinct.

Upon examination he is found to be somewhat anæmic. The posterior three-fourths of the left side of his tongue, as well as the floor of the mouth over a corresponding area, are involved and ulcerated. Jaw apparently not diseased; no evidence of salivary glands being so. Tongue firmly bound down to the floor upon the left side. The mass below angle of jaw upon his left is immovable and half the size of a lemon.

Dr. Brewer operated, December 13, 1900, for excision of the left external carotid. Chloroform anæsthesia. Incision revealed very extensive lymph-nodular involvement, extending well down to the region of the thyroid gland, and up to the jaw. The deeper parts surrounding them seemed infiltrated with the disease. Impossible to remove all the extension into the neck.

The steps of the external carotid excision were those heretofore repeatedly described. It is noted in the history-book that it was possible not only to tie the other six branches individually, but also "the internal maxillary and temporal were successively ligated."

(The essayist has more often failed than succeeded in accomplishing this, because of the bifurcation occurring so high in the substance of the parotid gland. Usually, but not always, he has had to be contented with ligating the external carotid high in the gland, without quite reaching the internal maxillary and temporal branches.)

Second operation upon this patient December 21, 1900. Again chloroform anæsthesia, and the excision of the artery completed with ease. No enlarged lymph-nodes found. Wounds healed, and patient discharged "improved" January 12, 1901.

This case counts, of course, only as two instances of successful ablation of the vessel under discussion. The time is far too brief since the entry "improved" for us to speak as to the final result. Because of the extensiveness of the disease, and the fact that "the deeper parts seemed infiltrated with it," probably there was a fatal termination within a few months.

Case XXXI.

Carcinoma of Tonsil, Side of Pharynx, Soft Palate, and Tongue.

Patient, Henry Burgess, is Irish; *æt.* 56; married; a hotel porter. Family history good; denies venereal; no previous disease has any bearing upon present trouble. Admitted to Polyclinic Hospital, December 16, 1900; Dr. Bosher, house surgeon.

First symptoms appeared three months ago, with a severe toothache upon his right side, all his right molar teeth aching. He had two extracted, with some relief, but within a few days noticed a lump "under the right ear." This has increased until it is now double the original size; also has for the past month had some difficulty in swallowing. No loss of weight nor of appetite. Is, however, distinctly cachectic, and has grown too weak to fulfill his duties, which involve very heavy work,—lifting many trunks daily, etc. Says he now could hardly lift a heavy valise.

On admission the lump just mentioned proves to be one of several large lymph-nodes, just beneath the angle of the jaw. Probably this mass is as large as a hen's egg, and is still movable. The heading of this history states the extent of the cancerous disease visible within the mouth. Notwithstanding the toothache mentioned there seems by palpation, needle test, and inspection to be no involvement of the lower jaw. This case is unique in our experience in two respects: First, the extreme rapidity of development to this degree, particularly in one so old; and, second, the entire absence of suffering, save for the former toothache and some recent and present trouble in deglutition, he has had nothing to complain of, he insists, and he is evidently exceptionally intelligent for his class.

Upon December 18th his right external carotid was excised. Some delay with the mass of glands noted above. Operation required fifty minutes. During the last twenty of these he received 2 liters of saline infusion at 120° F., into his left median basilic vein, at the hands of the house surgeon. He left the table in fair condition, and the wound healed *per primam.* Dr. Jeffries, Polyclinic pathologist, reported that the piece removed from the mass in the neck was epithelioma. We

delayed the second excision for three weeks, trying to build up his strength with iron and other tonics. Upon January 8, 1901, with the house staff's assistance, once more the writer operated, excising the left external carotid. This proved simple, and required but two and a half minutes to have a ligature thrown about the origin of the external carotid (but not yet tightened, for the reason named under "Technique") and but twenty-two minutes to complete the excision.

Primary healing followed, and he left the hospital in fifteen days. There was rapid shrinking of the large tonsil (right) and of the swelling in that side of his tongue, near the base. This whole irregularly shaped lump had perhaps the bulk of a turkey's egg originally (on admission), but within a month it became one-half that size and much harder to the touch. As it shrank the tongue became less movable, and swallowing and articulation were imperfectly performed, more so than when the mere bulk had caused trouble with both.

The patient continued in this state, and we were hopeful of quite a long respite, but early in March severe pain in the tonsil appeared. This was soon accompanied by a very rapid redevelopment of the tonsil, which, within a fortnight, sprouted out a fungous, ulcerated mass. Evidently through some source it was getting a renewed blood-supply. For the first time he now had much suffering and fœtid saliva. He begged for relief. He was informed that so extensive was his growth from the first that its extirpation was out of the question. However, we finally agreed to remove, as a temporary help, the enlarged tonsillar mass, or most of it, from within the mouth. This was accordingly done at the Polyclinic Hospital upon April 17, 1901. The operation was simple, short, and not much blood was lost. He, however, bore it very badly, and in spite of hot saline intravenous infusion, strychnine, and other restoratives he collapsed, died from shock April 18, 1901, just four months after his initial carotid excision. It is regrettable that permission for autopsy was refused.

In this case we have two more instances demonstrating the rather surprisingly safe nature, considering malignant cachexia, of carotid excision; but it is a question whether this man's life was prolonged at all by these operations. No one who saw his state when first admitted to the hospital could, however, doubt that his end was near. Though not then painful nor subject

as yet to ulceration, the cancer within his mouth was widespread indeed, it was of rapid development, and the usual most terrible terminal conditions could not have been long delayed. As a guess, the writer would venture the thought that the arterial source of the recrudescence, after shrinkage, in this case was the mylo-hyoid branch of the inferior dental, for this would easily reach both the enlarged tonsil and the mass in the side of the tongue and floor of the mouth.

Getting its blood from the internal maxillary, and this, in turn, by anastomosis with orbital vessels, from the internal carotid, this small mylo-hyoid artery could well be a source of peril. It will be remembered that in certain lower-jaw tumors the histories of which are included in this essay the operator was careful, in trephining the ramus to expose and tie off the inferior dental artery, to go high enough—about opposite to the internal foramen—to include and occlude the mylo-hyoid branch. Also in at least one case here recorded this control of the mylo-hyoid and inferior dental was accomplished from behind the ramus without trephining it.

Case XXXII.

Epithelioma of Tongue and Floor of Mouth.

(Case of Drs. G. E. Brewer and P. R. Turnure.)

Patient, Q. J. Whitten; *æt.* 53; Ireland. Admitted, December 23, 1900, to Roosevelt Hospital. Family history negative. Denies venereal infection. Personal history unimportant, so far as bearing upon any question of malignancy. Has always been temperate. Smokes moderately, using a pipe, but not a clay pipe. For three years has had epileptic fits (frequency not mentioned). Teeth have always been bad. Has worn artificial teeth for two years, and complains that they never fitted well; conceivably this may be a factor.

Present trouble: five to six months ago patient noticed a small sore upon the left side of his tongue, where the dental plate rubbed. At first no pain from this; only soreness during eating. Steadily the ulcer deepened, and induration about it

developed and spread, interfering with eating and speech. First observed lumps in his neck about six weeks ago, just behind the angle of the jaw upon his left. At this time went to a dispensary, where he was treated by gargle. Not improving, he was told to go to a hospital for operation, which he had at length done. For a month has had some pain in the mouth, shooting up to the temporo-maxillary articulation. Has lost about twenty pounds in weight during past half-year. Upon examination of left side of the tongue, one and one-half inches from tip, I find an elevated mass about one inch in diameter, situated at its edge and beneath, also involving the floor of the mouth. It bleeds easily. Tongue is bound down on this side, but is not tender. Speech is thick. Several enlarged glands felt under the angle of the jaw and down along the anterior edge of the sterno-mastoid upon same side. Pathologist at Roosevelt pronounces a specimen cut from mouth upon December 24, 1900, to be epithelioma.

First operation by Dr. Turnure, the house surgeon; chloroform, later ether, anæsthesia. Excision of left external carotid and enlarged glands of neck. The operation proceeded as usual. Dr. Turnure was able to control by ligature the internal maxillary and the temporal, severally. This is rather exceptional, and indicates a bifurcation of the external carotid rather lower in the parotid gland than often is found. Recovery satisfactory.

Second operation by Dr. Brewer. Gas and ether anæsthesia. Date, January 14, 1901. Excision of the right external carotid, plus a few enlarged glands. Patient recovered smoothly, and was discharged from the hospital in an "improved" condition January 27, 1901.[1]

Case XXXIII.

Case of Thomas Clifton, by the essayist. See details in Chapter IX, as upon one side the injection-technique was added.

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[1] Dr. Brewer does not know the subsequent history of this case. Since we have had no permanent cures of carcinomata by this plan, so far as I know, probably the patient finally died of his disease, though living some months longer than otherwise he would have done. This, at least, would be an average result in cancer as distinguished from sarcoma.

Case XXXIV.

In addition to the foregoing, Dr. Alexander B. Johnson, of the New York Hospital, who has reported herein, with dates and some degree of detail, two cases of his upon whom he performed the carotid excision, also reports as follows, in a letter to the essayist dated September 24, 1901:—

While Assistant Visiting Surgeon to Roosevelt he performed in that hospital this operation for the first time in his experience. This was a few years ago, but he cannot now remember name, date, nor exact circumstances further than to be able to say that the case was a male patient suffering from malignant disease, that he excised both external carotids upon different occasions; and that the patient recovered and left the hospital in due time.

It is regrettable that we cannot farther trace this case. It must simply go upon our records as standing for two more external-carotid excisions without fatality, but as valueless regarding the control of malignancy.

Case XXXV.

Recurrent Epithelioma of the Lower Lip.

(Case of Dr. G. E. Brewer.)

The disease involved also the lower jaw, with extensive infiltration in the submaxillary region. Glands were removed and the external carotid excised late in the year 1900. Four weeks later there was secondary hæmorrhage, which was met by ligating the common carotid. Pneumonia developed at this juncture, and in his weakened state promptly proved fatal. We regret that, because of Dr. Brewer's inability to furnish additional data, for which we have asked, the essayist is unable to add to the very meager details of this case. As it stands, it simply adds one to the list of excisions.

CASE XXXVI.

Recurrent Epithelioma of the Lower Lip.

(Case of Drs. G. E. Brewer and Clarke.)

Patient, S. Dolinski, *æt.* 66; Russian; admitted to Roosevelt Hospital, New York City, February 3, 1901. Family and personal history not obtained, except in relationship with present trouble.

Two years ago a sore appeared on the lower lip, right, and a little later there were pain and swelling of the "glands adjacent." Patient says he has been twice operated upon for this disease: eighteen months ago and again two and a half months ago, and, at the latter, glands in the right side of his neck were removed. Since then a persistent sinus has been maintained below the horizontal ramus of the jaw, discharging foul pus. Suffers pain down the neck and right shoulder. Upon examination scar is seen of old operations upon his lip and neck. The floor of the mouth is extensively indurated and ulcerated, the tongue being bound at that side.

Operation, by Dr. Brewer, February 4, 1901. Excision of the right external carotid and superimposed glands. Submaxillary gland, which is infiltrated with the cancer, was also dissected out and removed. The bifurcation of the common carotid was higher than usual, adding to the difficulty of work upon the branches of the external carotid. The hypoglossal nerve was accidentally divided. By a short common trunk the occipital, superior thyroid, and ascending pharyngeal arose from the external carotid. The lingual, facial, and posterior auricular arose from another common trunk, similar to the foregoing, and one-fourth inch above it. The temporal and internal maxillary were given off from the end of the external carotid just above these two main branches. Pathologist's report: epithelioma.

Second operation by the house surgeon, Dr. Clarke, February 25, 1901. Excision of the left external carotid. He notes that the superior thyroid arose from the common carotid; also that enlarged glands complicated matters. He found it necessary to ligate the superior thyroid and temporo-facial veins at

the jugular. The patient did well, and was, when the wounds were healed, discharged March 6, 1901, "improved."[1]

Case XXXVII.

Epitheliomatous Glands of Neck.

(Case of Dr. Robert F. Weir, of New York.)

Report taken from the hospital records (Roosevelt Hospital, New York; Dr. Clarke, house surgeon):—

Patient, Dr. George W. S., from New Jersey; American; *æt.* 56. Admitted March 13, 1901.

Previous history: Epithelioma of neck removed November 27, 1900; second operation, for recurrence in glands of neck, January 12, 1900.

Present trouble: About ten days ago noticed a small, hard lump under angle of jaw, right side, which he watched closely; states that it is increasing in size. Also observes a shot-like hardness in upper angle of first scar on cheek.

Upon examination we find a small, hard lump about one and one-half inches long, felt under the angle of his jaw in the right. Hardness as stated above in end of scar upon side of cheek.

Operation by Professor Weir upon March 13, 1901, chloroform anæsthesia: Incision beginning at center of lower lip, splitting this vertically, and continuing down to lower border of jaw, then curving outward below lower border to a point behind the angle. A vertical incision over sterno-mastoid from outer end of this one downward for three inches. Also, old scar on cheek excised.

Neck incision deepened to expose thyroid gland, jugular vein, and deep muscles of maxillary region, removing parts of hyoglossus and genio-hyoid muscles. Lingual artery ligated and divided. Floor of mouth invaded. Deep fascia dissected up to surface of lower jaw and removed. All discoverable lymph-nodes cut out.

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[1] The footnote accompanying Case XXXII of Dr. Brewer applies equally to this one.

Excision of external carotid decided upon. Vessel exposed, ligated, and divided below superior thyroid branch. This, with posterior auricular and occipital ligated and divided; lingual and facial also; then lower end of artery was passed above digastric, and finally pulled down and ligated at highest possible point; but the two terminal branches were not seen. (Further details of operation, not material to the topic in hand, are omitted.)

Pathological report: Sections show inflammatory lesions, but no evidence of recurrence of epithelioma.

This patient's wound evidently did badly. No details are recorded except that he had three secondary hæmorrhages; and immediately following the last of these Dr. Weir operated again upon April 25, 1901, hoping to save his life from this peril. Incision alongside of lower part of old scar in his neck, over carotid artery, deepening it through scar-tissues until the source of the bleeding was reached. This proves to have been the stump of the external carotid artery, close to its juncture with the common carotid. The written report does not specify which vessel was the source of the bleeding; and the statement just made is upon the authority of Dr. Funke, a member of the resident staff, who was present during this operation. (Dr. Weir is now absent in Asia.)

The further operative details as set forth in the Roosevelt Hospital history-book are as follows: After reaching the common carotid this was dissected free from the scar-tissue and ligated twice near its point of bifurcation, and between these was divided. The internal carotid was next tied above the point from which blood had been escaping, and the portion between was excised.

Note the highly interesting statement that follows (by referring back to the text it will be seen that at the excision of the external carotid all its eight branches were accounted for in the description but one, the ascending pharyngeal): On examination the ascending pharyngeal artery was found to be intact; preventing a good clot-formation in the stump of the external carotid, no clot being found at the point of ligation.

The patient died upon the following day, presumably of shock.

Since this unfortunate error in technique was, according to the record, the cause of the hæmorrhages, which resulted in

his death six weeks later, should we class this case among fatalities due to the severity of the operation of carotid excision? It seems to us not. We therefore omit it from our table of results, but describe it here, by kind permission of Professor Weir, because of its extreme interest to all surgeons, and in order that the reader may judge for himself as to whether or not we have decided properly, all the circumstances considered.

Case XXXVIII.

Epithelioma of the Larynx.

(Case of Dr. Howard D. Collins, of New York.)

Christina Nielson, Swede; *æt.* 43; City Hospital, service of Dr. Francis J. Quinlan, laryngologist. Patient was troubled, for several months, with pain in throat on swallowing and by a "stinging" cough. Repeated examinations by Dr. Quinlan were negative, and case supposed to be hysterical.

About March 10, 1901, an ulcerated area was seen in the upper part of the larynx and in the adjacent pharynx. Piece removed with microscopical report of "epithelioma" by the pathologist, Dr. Thayer.

Operation, March 20, 1901. Dr. H. D. Collins, assistant visiting surgeon, operator. Ether anæsthesia. It was planned to excise both external carotids, upon different days according to the method devised by Dr. Dawbarn. On right side carotid did not bifurcate into external and internal carotid until the vessel was under cover of the angle of the lower jaw. The lingual and superior thyroid branches, found arising by a common trunk, were identified, ligated, and divided. External carotid was ligated above and below this common origin of lingual and superior thyroid and divided.

On the left side arrangement was normal. The external carotid was ligated just above the bifurcation of the common carotid. Each branch of external carotid was ligated up to its two terminal ones; the external carotid was again ligated at the highest possible point, and its whole length excised. Wounds sutured with fine catgut.

At close of operation her face was anæmic and cold. Patient made a good recovery from the operation. For the first week thereafter she coughed a great deal, but the mucus was much less bloody than before the operation.

At the end of a week the wounds were healed. Laryngoscope showed a more marked œdema. From this time on her symptoms gradually grew worse, and the patient died on May 10, 1901.

Post-mortem examination showed an ulcerated area over an inch in diameter occupying the anterior wall of the œsophagus and also infiltrating the posterior wall of the larynx and adjacent pharynx. A specimen examined was again pronounced epithelioma.

Dr. Collins adds upon May 23d: "This case is not properly one to be included (as to hope of improvement) in the reports of cases operated upon, for malignant disease, by 'the starvation process' devised by Dr. Dawbarn.

"The anatomical arrangement of the right external carotid was such that the operator fully realized at the close of the operation that the procedure did not carry out the points principally emphasized by Dr. Dawbarn, and that in this case nothing had been gained."

NOTE: Much the same comment would seem justified in this case as in that of Dr. Lilienthal, although the outcome was more fortunate. Apparently, however, Dr. Collins may have felt that as he did not complete, because of anomaly, his arterial excision upon the right, and therefore there was a shorter cut and less dissection, by fully half, than otherwise, the risk of shock from proceeding at once to extirpate the left carotid was not extreme.

Obviously the first operation—that upon the patient's right—cannot be included in our list of external-carotid excisions. This case counts simply as one such complete excision, with recovery from the operation; but, as might be anticipated where the work cannot for any reason be done thoroughly upon both sides of the neck, there was no improvement or only a brief one. The case of Busse (first in our histories) shows as long a period of gain as any will do, prob-

ably, after ligation of the superficial carotid for cancer upon one side and excision of this vessel upon the other. And in that case, as the notes show, a final extirpation of the growth showed a very abundant blood-supply to it, doubtless chiefly from the side simply ligated.

In this patient of Dr. Collins one of the chief sources of danger—the occipital artery, because of its free anastomosis with the subclavian system—was left uncontrolled by ligature. This is not stated as a criticism, but simply as showing the unfortunate nature of the case.

In doing starvation work for laryngeal growths it will certainly be advisable to find and tie the inferior thyroid arteries too: ordinarily an easy task.

Case XXXIX.

Sarcoma of Right Upper Jaw.

(Case of Dr. C. L. Gibson, of New York.)

The following abstract is all that Dr. Gibson, his time being greatly occupied, could now give the essayist; it, however, covers the main points, including one which we feel to be absolutely essential; otherwise, in event of the patient's permanent recovery, we cannot rightfully claim—whatever the clinical manifestations were when at the worst—that the case was one of malignant disease. I refer to a microscopical examination by an able pathologist.

Wilson (negress). Inoperable sarcoma of right side of the superior maxilla. Admitted to St. Luke's Hospital, New York City, June, 1901. Examination by the hospital's pathologist proved the accuracy of the diagnosis. The patient was subjected to Dr. Dawbarn's operation upon June 14, 1901, in St. Luke's Hospital, the right external carotid being excised. The operation presented no difficulties. The patient positively declined further operative procedures and left the hospital when the wound had healed. No change in the condition of the tumor was observed. . . .

Here was a case of the unintelligent, obstinate kind, to which allusion has been made before in the course of these histories. With such people it would seem best to excise the external carotid upon the sound side first; for, otherwise, a cutting operation having already been done upon the side where the tumor is, any slight shrinkage they may note following it will be deemed evidence that they are really now on the road to recovery, and further operation will be refused.

CASE XL.

Sarcoma of the Upper Jaw.

(Case of Dr. A. B. Johnson.)

Robert Gibson, *æt.* 47; Irish; married; admitted to New York Hospital August 6, 1900. Family and past history, negative. Habits good. Last March commenced to have severe pain in right side of the head, principally over the parietal region. This was very severe and continuous day and night, lasting for two months. About this time he noticed that the right nostril was closing up, which was treated by his doctors all through the month of May, small pieces being removed from the inside of the nose two or three times a week. This gave relief from pain. He could breathe through both nostrils easily by the last of May, but by June 10th they were closed again. By the latter part of June the growth had appeared in the roof of the mouth. July 2d his doctors cut out a portion from the roof of the mouth and they told him it was sarcoma. Two weeks later the growth in the mouth was as large as before.

Right side of the face has been swollen, off and on, during the greater part of the time, but only since fourteen days ago has its swelling been permanent. The right eye has troubled him since April. Hearing on the right side has been impaired since the latter part of June. Has lost twenty-five to thirty pounds in the last three months. Has taken only liquid nourishment during the last two months.

Physical examination: Right cheek bulging, discolored, veins dilated; right eye elevated, protruding, vision impaired (can count fingers). The roof of the mouth on right side and

over beyond the median line occupied by a ragged, ulcerated swelling; swallowing and breathing difficult. Hearing by the right ear is very much impaired. Very much emaciated; speech indistinct.

Operation, August 8, 1900, by Dr. Johnson. Gas and ether anæsthesia. Excision of the right external carotid artery was performed. No note of anything unusual in the technique nor of any special difficulties. Patient did well and was discharged improved, August 13, 1900. Dr. Johnson, in a personal note to the essayist upon September 23, 1901, says: "This patient's tumor diminished rapidly in size. Excision of the opposite vessel was proposed at the end of ten days, but the patient positively refused, and was lost to further observation by going to an address unknown in another city."

This case, again, is a striking illustration of the need of adopting, in dealing with the unintelligent and obstinate, the essayist's advice to operate first upon the sound-side external carotid, for reasons named heretofore.

Case XLI.[1]

Carcinoma of the Tonsil.

(Case of Dr. John C. Munro.)

"Male, *æt.* 40. Disease of four to six months' duration. Cervical glands enlarged. Boston City Hospital.

"August 14, 1901. Right external carotid and all branches excised by myself.

"August 26th. Left side; similar operation by myself.

"September 2d. Discharged to Out-patient Department the tonsil looking a little cleaner.

"I saw patient several times in the next few months, but there was no improvement and his later history is unknown."

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[1] Cases XLI, XLII, and XLIV are quoted from a report to the essayist by Prof. John C. Munro, of Boston.

CASE XLII.

Epidermoid Cancer of the Lower Jaw.

(Case of Dr. John C. Munro.)

"Male, *æt.* 49. Disease of six months' duration. Boston City Hospital.

"August 20, 1901. Excision of left carotid and all branches by myself.

"August 28th. Similar operation on right by Dr. J. T. Bottomley.

"September 4th. Discharged to Out-patient Department in poor general condition. Later history unknown."

CASE XLIII.

Carcinoma of the Tongue.

(Case of Dr. Alexander B. Johnson, of New York.)

Patient, Felix Lavelle, *æt.* 44. Family history negative. Patient had a chancre two years ago, followed by mild secondary symptoms of syphilis. Does not smoke, and has used no alcohol for three years.

Present history: Trouble began four months ago with small ulcer upon the side of the tongue (which side not stated). This finally healed; but meanwhile the entire tongue became enlarged, its motions were limited as it became bound down, and it is very painful. Patient has lost flesh and strength. The past four months he has devoted to antisyphilitic treatment, but the tongue has grown worse steadily.

During the past few weeks the glands in the neck—upon the affected side chiefly—have become swollen.

Tongue is now found fixed and infiltrated, and the cancerous growth within it extends backward to the epiglottis, and it is ulcerated over the left base.

Operation, September 5, 1901. Dr. Johnson, using gas and ether anæsthesia, made a sufficient incision in the neck upon the left to remove enlarged gland for pathologist's ex-

amination. Upon September 8th he performed upon the patient's right side, by aid of the same anæsthesia, the operation of excision of the external carotid. Upon September 21st the other external carotid was excised, *plus* the remaining diseased glands.

The patient has done excellently, and is now sitting up, and out of danger, so Dr. Johnson reports. It is too early to be able to speak as to the value of these surgical procedures upon the malignant growth within his mouth. The case simply counts as two more instances of the safe ablation of the external carotids.

Case XLIV.

Vascular Round-Celled Sarcoma of the Tonsil.

(Case of Dr. John C. Munro.)

"Female, *æt.* 29. Disease of four months' duration. Boston City Hospital.

"November 30, 1901. Excision of left carotid and all branches by Dr. F. B. Lund.

"December 10th. Similar operation on right by myself. Coley serum used for several weeks.

"January 9, 1902. Enucleation of growth by myself, through mouth on account of steady increase in size of obstruction. No bleeding to speak of, except venous.

"February 6th. Increase in growth. General condition worse. Discharged to friends, failing steadily."[1]

Case XLV.

Sarcoma of Antrum.

(Case of Dr. A. T. Bristow, of New York.)

"Long Island College Hospital. Patient a longshoreman, *æt.* 51. Present illness began four months before admission to

[1] In a letter dated October 6, 1902, Dr. Munro says: "These few cases proved nothing. I believe in the operation and shall follow it up whenever I can corral a case. I confess, however, that I do not admire the paraffin injection idea. The gain seems to me slight, relative to the risk."

the hospital, with a swelling of the right side of the face and sharp pains in the swelling and about the face and head. These pains increased in severity and the tumor in size until patient was admitted to hospital. Transillumination of the antrum revealed this cavity as the source of the neoplasm. There was the same obstruction of the nostril and the bulging downward of the hard palate as in the other cases. On January 29, 1902, I extirpated the right external carotid. This man had a short, thick neck, and the common carotid bifurcated just below the hypoglossal nerve, but there was no matting together of the tissues, and consequently the dissection, though not an easy one, was feasible. No vaselin was injected. Patient's convalescence was much imperiled by an attack of œdema of the lungs and irregular and weak heart-action, but he recovered from the first operation. He had been taking morphine constantly for pain, which ceased immediately after the extirpation and did not return until about a week before the second operation, which was done on March 7th, and took just one hour, was entirely uneventful, and practically bloodless. The patient, however, again developed œdema of the lungs, and was found dead in bed forty-eight hours after operation. The autopsy showed a left ventricular wall diseased and of about one-fourth of an inch in thickness. The wound of operation was dry. The common and internal carotid on the side first operated upon were excised for the purpose of inspecting the site of the external carotid where it is given off from the common. It was remarkable to see the completeness with which Nature had obliterated the old orifice into the common carotid. There was nothing but a slight depression to mark the site of the external carotid, and a sort of bud-like excrescence externally where the vessel had been cut off. Regarding this patient, I should say in conclusion that the operation of carotid excision should not be blamed for his death."

Two other cases of Prof. A. T. Bristow, of Brooklyn, will be found detailed in Chapter IX of this essay. They are placed there because that chapter is devoted to the injection cases, and the first two of these patients were subjected to this method.

Case XLVI.

Angioma of the Upper Lip.

(Case of Dr. George Woolsey, of New York.)

"The following is a brief statement of the case of the baby operated on by me upon both sides of the neck by excision of the entire external carotids (angioma, closely resembling angiosarcoma, was the report of the pathologist at Bellevue Hospital):—

"A. N., *æt.* 6 months, admitted to the Second Surgical Division of Bellevue Hospital April 7, 1902. Eight days after birth the mother noticed a small 'pimple' on the right side of the upper lip, which increased in size, but did not raise up the lip. When the baby was six weeks old the growth was removed (I think the mother said in the Seney Hospital, Brooklyn). She added that the operation was so bloody that it could not be satisfactorily completed. When sutures were removed recurrence was promptly noticed, causing a projection of the lip.

"On examination a growth the size of a walnut projecting from upper lip on right side. It involves the border of the lip and extends into the floor of right nostril. Pulsation seen and felt along its lower border. Scars of old operation noted.

"April 14, 1902, chloroform anæsthesia. Operation by me. Excision of left external carotid and its branches. Primary union; stitches removed April 21st.

"April 26th right external carotid and its branches excised. Artery much larger than upon the left side, but whether this was due to collateral circulation could not be determined. Pulsation ceased on tying ligature. Primary union.

"April 30th. Tumor, which is apparently smaller and bluer, excised down through the border of the lip. Some angiomatous tissue extending beyond tumor removed also. Some bleeding (arterial) occurred, but nothing serious, though more than in a healthy lip apart from the coronary arteries. The cause of this bleeding was some angiomatous tissue not removed before.

"Suture as in harelip cases."

In a second letter Professor Woolsey remarks: "Some physicians who saw the sections said it was angiosarcoma; but

the pathologist's report is true angioma." Following this was a description of the anatomical arrangement of the branches of the external carotid, differing upon the two sides. As this has no bearing upon the technique, nor prognosis, though interesting to an anatomist, it is omitted. This little patient's case cannot apparently be classed as a genuine sarcoma, and hence is useless so far as is concerned the question of the special value of this plan of controlling malignancy. It is, however, of much interest as demonstrating once more, and in the youngest of all cases so far recorded, the safety of the author's operation of arterial excision; and also that it made possible the removal of the tumor without jeopardy from the chief cause of shock: bleeding. The contrast with the previous operation is striking: where, in Brooklyn, it could not be completed because of bleeding; and at that early age, six weeks, it must have been much smaller than upon admission, at six months, to Bellevue.

Case XLVII.

Sarcoma of the Upper Maxilla.

(Dr. G. E. Brewer's First Case.[1])

Patient, J. Pantel, German; *æt.* 26; admitted to Roosevelt Hospital, N. Y., service of Dr. Weir, June 1, 1900. Family history negative. Personal history previous to present attack without interest in this connection. Kidneys and other organs normal.

About three months ago, following toothache for several days, a swelling appeared under the right cheek. There was no pain in it nor acute symptoms. Toothache disappeared temporarily, but tumor has gradually increased in prominence. Six weeks ago two teeth on the right side of the upper jaw were drawn; one month ago two more were extracted, hoping to relieve discomfort, but fruitlessly. Depression of the roof of the mouth next appeared, and rapidly increased until deglutition was somewhat interfered with from bulk of the tumor.

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[1] This case not included in tables of statistics for reasons named in the text of it.

One month ago, also, the right nostril became occluded by the growth. There has been no severe pain and no discharge at all from the tumor, either from mouth or nose. Slight hæmorrhages, however, almost every day during past six weeks, from mouth. Patient has lost forty pounds in weight since this trouble began. Nevertheless he does not look cachectic.

Dr. Brewer operated upon the right external carotid June 2, 1900. Nitrous oxide followed by ether anæsthesia. The bifurcation of the common carotid was noted as being one-half inch above the upper border of the thyroid cartilage. The external carotid was smaller than the average. At this sitting this artery was ligated, and the superior maxilla was excised.

Upon August 31, 1900, the left external carotid was sought for, in an endeavor to excise it. It was not found, but branches, springing from a common trunk which came from the common carotid, supplied the thyroid, lingual, facial, and occipital circulation. The ascending pharyngeal was found and ligated. What seemed to be the internal carotid was seen. It was small in size for that artery. It was decided at length to ligate the common carotid, and then the internal carotid as high as possible, and the trunk between was cut out. The upper end of the internal carotid proved somewhat diseased and easily torn, compelling religation at a yet higher point. Wound then closed.

September 2d the patient died, presumably of cerebral thrombosis.

COMMENT: This case has been included in our lists because of its anatomical interest rather than for any other reason. As the right external carotid was tied, only, and not excised, the principle upon which we are now at work was not carried out; and at the very best we should have hoped for no longer relief from increase of growth than in the first case among our histories (Busse, *q. v.*). As to the left side, since no external carotid at all was found, obviously we cannot class this attempt among external-carotid ablations. It is recorded that "three or four large glands" caused trouble in front of the carotid region. These, plus the unusual degree of dissection and loss of time incident to finding and following out the facts of

this anomaly, must have together produced a degree of shock greater than the customary excision of the external carotid entails. Ligation of the common or of the internal carotid, both of which were performed in this operation, added greatly to the risk. According to Wyeth, 41 per cent. is the mortality of these ligations.

The entire absence of an external carotid in this case is by no means unique. Under the discussion of the anatomy of this subject we allude to the fact, quoting Deaver, volume ii, page 187, that this artery may be absent; the branches of the external carotid arising, instead, in more or less of the regular order from the common carotid artery, which continues upward as the internal carotid. This, indeed, is the commonest anomaly; and, as we will show later on (Chapter VII), is the rule in dogs.

Should the profession adopt the suggestion of Dr. Wyeth, and supplement the writer's starvation work by injecting the terminal part of the external carotid with, for example, some plastic material, a case like this just mentioned of Dr. Brewer would not be devoid of peril. If, following the rule of considering that branch of the common carotid which itself gives off branches in the neck as being the external carotid, the surgeon proceeds to excise it,—when no other carotid exists there,—the usual danger from ligating the internal or the common carotid results, as just stated. And if the injection plan also be used, a prompt death upon the operating-table will follow, from plugging the circle of Willis and other vessels at the base of the brain.

Such danger is, however, removed if we recognize its possibility and watch for it. We need only remember neither to excise nor inject a supposed external carotid until we have made sure that there is an additional carotid, given off by the common, and supplying no branches in the neck.

The following pages contain a tabulation of the histories of the cases described in this chapter:—

No.	Patient.	Operator.	One or Both Sides.	Date.	Immediate Results.	Results within Three Years.	Results, Ultimate.	Remarks.
1	Busse. Male, 26.	Personal.	Unilateral.	June 10, 1895.	Operative recovery.		No recurrence after more than 8 years.	Sarcoma. Naso-pharynx. Excision on one side; ligation on the other. Tumor partially removed and base cauterized.
2	Callahan. Male, 34.	Personal.	Bilateral.	October 5 to 15, 1895.	Operative recovery.		No recurrence after 5½ years.	Subperiosteal sarcoma of lower jaw. Tumor remains shrunken.
3	Klebr. Female, 24.	Personal.	Bilateral.	February 11 to 21, 1896.	Operative recovery.	No recurrence within 3 years.	No report after 3 years	Sarcoma of upper jaw.
4	Cesare. Male, 29.	Personal.	Bilateral.	February 11, March 1, 1896.	Operative recovery.		No recurrence after 5½ years.	Subperiosteal sarcoma of lower jaw. Tumor remains small.

5	Engel. Male, 45	Personal.	Unilateral.	March 5, 1896.	Operative recovery.	Died from excision for recurrence within a few weeks.		Epithelioma of tongue. Half the tongue excised at time of ligation. Recurrence in a few weeks in the other half. Excision, followed by death from shock in 48 hours.
6	Holahan. Male, 54.	Personal.	Bilateral.	March 17 to 31, 1896.	Operative recovery.	Died 1 month after second excision, from pneumonia.		Epithelioma of mouth.
7	A. M. J. Male, 26.	Personal.	Bilateral.	April 18 to May 2, 1896.	Operative recovery.		No recurrence after more than 7 years.	Sarcoma of antrum. Growth also excised at time of second operation.
8	Male.	Dr. J. C. Da Costa.[1]	Bilateral.	August 26 to September 9, 1896.	Operative recovery.	Died from suffocative attack after out of danger from wound.		Recurrent sarcoma of neck.

[1] "I have become more and more persuaded of the remarkable efficacy of this operation in producing shrinking of malignant growths in the carotid area. Last winter I had a very notable example of it, and this winter another one. So far, I have operated upon four patients and Dr. Hearn on two." This is from a letter dated November 28, 1902. The author regrets that Dr. Da Costa and Dr. Hearn have not had time to furnish further details, and hopes to include these in a later edition. Meanwhile, in the absence of such details, he does not include these cases in his tabulated list.

No.	Patient.	Operator.	One or Both Sides.	Date.	Immediate Results.	Results within Three Years.	Results, Ultimate.	Remarks.
9	Walker. Male, 25.	Personal.	Bilateral.	September 11 to 21, 1896.	Operative recovery.	No recurrence after 1 year; no subsequent report obtainable.		Giant-cell sarcoma of the upper jaw. When last heard growth still present, but small and stationary.
10	O'Donnell. Male, 45.	Personal.	Bilateral.	December 1 to 8, 1896.	Operative recovery.	Death several weeks after second operation, from pneumonia, due to exposure.		Sarcoma of lower jaw.
11	White. Male, 34.	Personal.	Bilateral.	April 7 to 17, 1898.	Operative recovery.	No report after about 4 months; was then well.		Sarcoma of hyoid bone and adjacent parts.
12	A. C. M. Female, 18.	Dr. W. W. Keen.	Unilateral.	October 12, 1898.	Operative recovery.	Death 14 months after operation, cause unknown (metastasis to brain?).		Myxosarcoma of tonsil. Growth excised. There was a slight recurrence; also excised.

13	Mrs. H. S. Female, 50.	Personal.	Unilateral.	February 7, 1899.	Operative recovery.	Death 2 months subsequently from an operation (see history).		Carcinoma of neck, medullary. Growth also enucleated.
14	Degnan. Male, 50.	Personal.	Bilateral.	March 15 to 31, 1899.	Operative recovery following first carotid excision.	Death from shock following second carotid excision.		Epithelioma of upper jaw.
15	Wolfe. Female, 56.	Personal.	Bilateral.	April 7 and 28, 1899.	Operative recovery.	Death from recurrence about 9 months later.		Sarcoma of upper jaw. One excision after recurrence.
16	Sullivan. Male, 57.	Personal.	Unilateral.	October 4, 1899.	Operative recovery.	Died from exhaustion due to disease 1 month later.		Epithelioma, left side of face. Had been excised 19 days before operation on artery.
17	Managua. Male, 62.	Personal.	Bilateral.	December 7, December 19, 1899.	Operative recovery.	No recurrence after nearly 19 months.		Sarcoma of tongue, floor of mouth, and right side of lower jaw.

No.	Patient.	Operator.	One or Both Sides.	Date.	Immediate Results.	Results within Three Years.	Results, Ultimate.	Remarks.
18	Giolito. Male, 64.	Personal.	Bilateral.	December 9, 1899; January 6, 1900.	Operative recovery.	No recurrence after 15 months.		Sarcoma of lower jaw, with extension into floor of mouth and tongue.
19	Schinirring. Male, 53.	Personal.	Bilateral.	December 30, 1899; January 24, 1900.	Operative recovery.	Died February 1, 1901, from operative shock following intervention for abscess of neck. No recurrence of cancer.		Carcinoma of tongue and floor of mouth.
20	Male, 49.	Dr. Willy Meyer.	Bilateral.	April 16 and 23, 1900.	Recovery from first operation.	Death from second operation plus two others at same sitting.		Ulcerating cancer, base of tongue.
21	Male, 50.	Dr. Willy Meyer.	Bilateral.	May 31 and June 18, 1900.	Operative recovery.	Death 6 months later from recurrence.		Inoperable, ulcerating epithelioma of right tonsil, soft palate, base of tongue, etc.

22	Male, 55.	Dr. Blake.	Bilateral.	July 19 and 31, 1900.	Operative recovery.	No further report.		Epithelioma of floor of mouth.
23	Female, 7 months.	Dr. Blake.	Bilateral.	August 10 and 22, 1900.	Operative recovery.	No further report after discharge as "cured," October 18th.		Angioma (?) of face (see text).
24	Semkin. Male, 52.	Personal.	Unilateral.	October 2 and 19, 1900.	Recovery from first operation.	Death following second operation, which could not—from masses of adherent glands—be completed.		Carcinoma of lower jaw, face, neck, floor of mouth, and tongue.
25	W. A. M. Male, 30.	Dr. Nicolson.	Bilateral.	October 3 to 17, 1900.	Operative recovery.	Improved.		Sarcoma of nose.
26	W. C. Male, 23.	Dr. Nicolson.	Bilateral.	October 10 to November 8, 1900.	Operative recovery.	Improved.		Sarcoma of upper jaw.

No.	Patient.	Operator.	One or Both Sides.	Date.	Immediate Results.	Results within Three Years.	Results, Ultimate.	Remarks.
27	Gibbons. Male, 61.	Personal.	Unilateral.	October 19, 1900.	Operative recovery.	Death nearly 3 months later from septic pneumonia following operation of opening a pus-pocket.		Recurrent carcinoma of tongue, jaw, and side of face.
28	Louis E. Male, 64.	Dr. Lilienthal.	Bilateral.	November 24, 1900. Both at one sitting.	Death from operative shock in 2 hours.			Sarcoma of upper jaw. Both external carotids excised at one sitting.
29	Male, 44.	Dr. Erdmann.	Bilateral.	December 1, 1900; January 15, 1901.	Operative recovery.	Death from malignant erysipelas 4 months later.		Epithelioma of face.
30	Quinn. Male, 41.	Dr. Brewer.	Bilateral.	December 13 and 21, 1900.	Operative recovery.	Patient improved when last seen (January 12, 1901). Probably died of disease later on.		Epithelioma of tongue.

31	Burgess, Male, 56.	Personal.	Bilateral.	December 18, 1900; January 8, 1901.	Operative recovery.	Death April 18, 1901, result of operation for partial excision.		Carcinoma of tonsil, pharynx, soft palate, and tongue.
32	Whitten. Male, 53.	Drs. Brewer and Turnure.	Bilateral.	December 24, 1900; January 10, 1901.	Operative recovery.	Left hospital improved, January 27, 1901. Probably died of disease later on.		Epithelioma of tongue and floor of mouth.
33	Clifton.	Personal.	Bilateral (other side injected too.)	December 24, 1900.	Operative recovery.	Death in May, 1901, from consumption.		Carcinoma of tonsil and adjacent parts.
34	Male.	Dr. Johnson.	Bilateral.	"Several years ago."	Operative recovery.	No further report.		?
35	Male.	Dr. Brewer.	Unilateral.	During 1900.	Operative recovery.	Death 1 month later from secondary hæmorrhage and pneumonia.		Epithelioma of lower lip and jaw, recurrent. The common carotid was ligated for the secondary hæmorrhage.

No.	Patient.	Operator.	One or Both Sides.	Date.	Immediate Results.	Results within Three Years.	Results, Ultimate.	Remarks.
36	Dolinski. Male, 66.	Drs. Brewer and Clark.	Bilateral.	February 4 and 25, 1901.	Operative recovery.	Discharged from hospital improved, March 6, 1901. Probably died of disease later on.		Recurrent epithelioma of floor of mouth.
37	G. W. S. Male, 56.	Dr. Weir.	Unilateral.	March 13, 1901.	Death on following day from shock.			Epitheliomatous glands of neck.
38	Nielson. Female, 43.	Dr. Collins.	Unilateral.	March 20, 1901.	Operative recovery.	Death from cancer of tongue, May 10, 1901.		Epithelioma of larynx.
39	Wilson. Female.	Dr. Gibson.	Unilateral.	June 14, 1901.	Operative recovery.	No further report.		Sarcoma of right upper jaw.
40	Gibson. Male, 47.	Dr. Johnson.	Unilateral.	August 8, 1901.	Operative recovery.	Tumor diminished in size rapidly. No further report.		Sarcoma of upper jaw; excision of artery on other side refused.

41	Male, 40.	Dr. Munro.	Bilateral.	August 14 to 26, 1901.	Operative recovery.	Unknown. Malignant area "looked a little cleaner" when discharged from hospital.		Carcinoma of tonsil. Probably not improved.
42	Male, 49.	Drs. Munro and Bottomley.	Bilateral.	August 20 to 28, 1901.	Operative recovery.	Poor general condition when discharged from hospital. Probably died of disease later on.		Epidermoid cancer of lower jaw.
43	Lavelle. Male, 44.	Dr. Johnson.	Bilateral.	September 8 and 21, 1901.	Operative recovery.	No further report.		Carcinoma of tongue.
44	Female, 29.	Drs. Munro and Lund.	Bilateral.	November 30, and December 10, 1901.	Operative recovery.	No good accomplished.		Vascular, round-celled sarcoma of tonsil. Patient failing when last heard of (February 6, 1902).

No.	Patient.	Operator.	One or Both Sides.	Date.	Immediate Results.	Results within Three Years.	Results, Ultimate.	Remarks.
45	Male, 51.	Dr. Bristow.	Bilateral.	January 29, March 7, 1902.	Operative recovery after first carotid excision.	Death after second. "Operation should not be blamed for this death" (see text).		Neoplasm of antrum.
46	Female, 6 months.	Dr. Woolsey.	Bilateral.	April 14 to 26, 1902.	Operative recovery.	Baby discharged cured.		Angioma "closely resembling angiosarcoma" of upper lip.
47[1]	Kenna.	Dr. Bristow.	Bilateral (other side injected, too).	November 26, 1901.	Operative recovery.	Patient still alive, tumor still inactive, in autumn of 1902.		Adenocarcinoma of nose and antrum.
48	Male, 53.	Dr. Bristow.	Bilateral.	December 19, 1901; January 30, 1902.	Operative recovery after first carotid excision.	Death, but not from operation (see text).		Sarcoma of antrum.

[1] Cases 47 and 48 are not placed in chronological order in the table, owing to their histories not being in this chapter.

CHAPTER III.

Study of the History Tabulation.

ANALYSIS OF TABLE.

A STUDY of the tabulated material gives the following summary as to the nature of the tumors treated by starvation ligature[1]:—

Cancer	24
Sarcoma	20
No definite report	2
Angioma	2
	48

Of the 20 cases of sarcoma, there was but 1 operative death, Case XXVIII; and in that the operator excised both external carotids in a weak and cachectic patient at one sitting. But for this instance the percentage of recovery from operation would be 100. In 1 other instance, Case XLV, the operator shows and states that death cannot fairly be attributed to the operation of arterial excision. Of the 18 survivors no report was obtainable after the first few months in most instances, being patients discharged from the public hospitals. These cases are therefore not available for permanent survival statistics, and it can only be said that there was operative recovery, with, in most cases, immediate benefit to the patient through reduction in the size of the tumor. We have but 11 patients available for statistics of recurrence[2] (fairly ultimate results).

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[1] A considerable further number will be found in the final chapter, devoted to the trial of carotid excision *plus* paraffin injection of certain branches.

[2] Meaning, of course, recurrence of growth and activity in a tumor which has become shrunken and quiescent as a result of the starvation-operation on the vessels.

Of this number, but 1 is positively known to have died from a return of the tumor activity[1]; though a second case (Case XLIV) was losing ground at last report — after two months. Another patient who died fourteen months after intervention may possibly have suffered from metastasis to the brain (Case XII). Neglecting this case as doubtful, we have but 2 recurrences out of all the sarcomata. Of the survivors, 1 was living and well at the end of one year, 1 at fifteen months, 1 at nineteen months, 1 at three years, 2 at five and one-half years, 1 at seven years, and 1 at upward of eight years. Regarding this last one, patient No. 1, the operation was of benefit by shrinking the growth to much more reasonable limits for operation; and during the period (several months) of such diminution in size this man's health radically improved, so that he was able thereby to meet and survive an operation otherwise assuredly fatal. It was, indeed, declined by another surgeon of New York as utterly hopeless. Nevertheless we do not count this case as one cured by the carotid excision, for reasons noted in the history itself. Taking the three-year limit as a radical cure, we have 4 definite recoveries out of 8 cases which survived the accidents of the first year; it must also be remembered to the credit of this operation that all of these but 1 (patient No. 3) were cases far advanced in their malignant disease, and ineradicable. They were, indeed, deemed hopeless by other means than this.[2] One of them (Case IX) did, indeed, have ablation of his upper jaw performed at the time of the second carotid excision. Since, however, this bone was so extensively attacked by the disease —a fusiform-celled sarcoma—as to be everywhere softened, and the eye had been noticeably bulged upward out of place by

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[1] Case XV. Involved orbit (as the event proved); hence hopeless, being supplied directly from the internal carotid.

[2] Some antedated the use of the Roentgen rays against malignancy; in a few more recent ones this plan or antitoxin injections, or both, had been tried unsuccessfully.

tumor-distension within the antrum, no experienced surgeon can doubt that this patient's malignant condition was not entirely surrounded by the knife; and that if left to itself, nothing else being done (in addition to excision of the superior maxilla), a speedy recurrence and death would have ensued. There was no attempt at encapsulation outside the softened bony limits. The pathological specimen has been saved in this interesting case, for the inspection of anyone who may wish to examine it.

The statistics of the 24 cases of cancer are so different that it is difficult to make a comparison. The mortality from various causes within the first year was heavy, comprising no less than 14 cases, classed as follows: Death from operation itself, 3; death soon after operation, but from causes independent of the latter and without recurrence, 6; death from recurrence of activity, 4; and from operation due to such recurrence, 2; 2 patients survived more than a year without recurrence, 1 dying of a cause independent of cancer, the other being alive in November, 1902.

There remain 8 patients not known to have suffered death or recurrence of tumor activity, but who have been operated upon so recently that the material is unavailable for statistics, or who could not be traced. There are, therefore, but 2 cases out of the 24 in which the result was positively known to be favorable for the operation (as to permanent cure, not as to temporary relief). However, patients are grateful for even a few months of life not otherwise obtainable.

The 48 patients were operated upon by 21 surgeons as follows[1]:—

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[1] A number of additional cases by the essayist and several other surgeons will be found detailed in the final chapter, because the injection-plan there studied, used in addition to the carotid incision, affects the statistics.

	Patients.	Operations.
The essayist	21	36
Dr. Bristow[1]	3	5
Dr. Brewer[2]	4	7
Dr. Johnson	3	5
Dr. Meyer	2	4
Dr. Blake	2	4
Dr. Nicolson	2	4
Dr. Da Costa	1	2
Dr. Lilienthal	1	2
Dr. Erdmann	1	2
Dr. Keen	1	1
Dr. Weir	1	1
Dr. Collins	1	1
Dr. Gibson	1	1
Dr. Munro[3]	3	6
Dr. Woolsey	1	2
	48	83

It thus appears that 83 operations have been performed by 21 surgeons upon 48 patients. In 1 each of the cases of Drs. Brewer and Johnson the number of ligations is not stated, and they are credited with but 1, in order to be on the safe side. The actual number of operations may therefore be stated as at least 83. Regarding the immediate mortality of the excision of the external carotid *per se*, it is difficult to ascertain the real fact, because in so many instances some additional operative measure was done, adding gravely to the jeopardy of the patient both from length of operation and dissection of tissues. In certainly a great majority of these cases—chiefly old and ineradicable disease—the lymph-nodes in the neck over the carotid were badly involved, and in consequence large and adherent. Sometimes this was also true of the submaxillary salivary gland; and the necessary removal of these structures

[1] Dr. Campbell, of New York, operated upon one side in a case of Dr. Bristow. See final chapter.

[2] Dr. Turnure and Dr. Clark each operated upon one side, in two patients of Dr. Brewer.

[3] Dr. Bottomley and Dr. Lund each operated upon one side in Dr. Munro's cases. To avoid misunderstanding as to the tabular list of patients, these operators are mentioned here, though their work is included in the table.

should be allowed for in computing the danger. Again, repeatedly in these histories the tumor itself was attacked at the same sitting in which the external carotid had been removed. Plainly, a death following this ought not to be credited solely to the arterial work.

It is because of these factors and others, such as the necessary weakness and cachexia attendant upon advanced malignant disease and which militate gravely against its chances from any operation, that no exact tabulation of percentages of death *versus* recovery from the immediate arterial operation are included herewith. As nearly as the essayist is competent to decide, however, by the light of his present experience of more than 50 such arterial excisions,[1] this operation is surprisingly safe. Wyeth's work giving a mortality of $4\,^1/_2$ per cent. for simple ligation of the external carotid (our only tabulated guide) is, of course, no longer of value in comparison, all those operations having been done in pre-antiseptic days. To-day, with modern asepsis, and with a skilled operator who has first practiced it repeatedly upon the cadaver, and in the absence of infiltrated and adherent glands or other complications, and in subjects not cachectic, the essayist believes that there should hardly be any mortality at all from the external-carotid excision; surely not much over 1 per cent. And simple ligation of the external carotid, which in experienced hands and favorable cases may easily be quite inside of three minutes and without loss of more than a few drops of blood, may under like conditions be said to have practically no mortality.

To Dr. Wyeth as a pioneer in carotid work great credit is due. Before his prize-work was accomplished the profession regarded with fear, upon purely theoretical grounds, even simple ligations of the external carotid, believing that because six of its eight branches are given off nearly touching one another and immediately after the bifurcation from the common

[1] Including the author's excisions in which the injection-technique also was employed, for which see Chapter IX.

carotid, and that hence no internal clot could form, a ligation of this branch of the common carotid must be perilous from secondary hæmorrhage.

Dr. Wyeth showed that this idea was not based upon the facts of surgical experience, and that no major ligation is safer than this.

CHAPTER IV.

Brief Essay upon General Considerations.

It was originally the essayist's intention to devote most of his paper to an essay proper, using as footnotes, as it were, the histories of the patients supplying the 83[1] operations. But, upon reflection, it seemed the better, if less customary way, to adopt a different procedure in the present instance. The discussion of matters naturally bearing upon the bibliography would come within the, so to speak, didactic province of the usual essay; but here the essayist is entirely without means for instituting such a comparison, since the plan under discussion is, so far as the library gives evidence, wholly new. It is for this reason that your essayist has deemed it best to discuss under each history such point or points as naturally arose, the reader having the reason or text for such comment then fresh in mind. This is the more natural since the topic of the essay is not one characteristic of the laboratory so much as of the clinic-room, and must be accounted valuable or the reverse by this standard alone. Hence, in a measure, the histories (Chapters II and IX) and their running comments as footnotes constitute a considerable part of our essay.

We shall now take up briefly, but in systematic order, the discussion of attempts to control, by cutting off blood-supply, the malignant growths within the nutritive radius of the external, or superficial, carotid system of vessels.

In order of thoroughness they stand as follows:—

1. Ligation of the superficial carotid upon one side of the neck.

2. Ligation upon both sides of the neck.

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[1] *Plus* those in the final chapter.

3. Excision of this vessel upon one side of the neck.

4. Excision of it upon one side of the neck, plus ligation upon the other side.

5. Excision of this vessel upon both sides of the neck.

6. Same as No. 5, plus controlling by ligature, at once or later, branches nearer the periphery of the system.

7. Same as No. 6, plus Wyeth's suggestion (see Chapters VII, VIII, and IX) applied to certain branches, especially the internal maxillary and superficial temporal, and the occipital.

As to No. 1, the resulting anæmia is a thing of hours or a few days at the best. Just prior to some severe and otherwise bloody operation about the face, for instance, it is strongly to be advised. For, as Butlin, in his work upon "Operative Surgery of Malignant Diseases" clearly shows, very many of the operative deaths in this most vascular region of the body are due to shock, "exhaustion" (a synonym), and hæmorrhage. As the chief cause of shock is admitted to be loss of blood, all three of these causes are practically identical. The essayist is puzzled to know upon what grounds, other than simply conservatism, Butlin can possibly oppose throughout his work, as he does, preliminary ligation of the external carotid. This procedure is to-day practically devoid of danger; and even in the pre-antiseptic days, as shown by Wyeth in his prize-essay of 1878, had the low mortality of $4\,^1/_2$ per cent. And its employment means almost bloodless operation in an otherwise excessively bloody field, and hence avoidance of many of these deaths from shock.

But within a few days, at most, after a single ligation of the external carotid the circulation is as free as ever. It is known to everyone that there are thousands—myriads—of nameless little vessels interlocking at the median line, and by which the freest anastomosis is quickly restored. These mere capillaries and tiny arterioles dilate, and thus carry an abundance of blood to the anæmic side.

When we come now to the somewhat more radical step

of tying both superficial carotids, what do we gain? A few days more of anæmia at best. Probably always, unless some rare anomaly exists, inside a week or ten days thereafter the pulse can again be felt in the temporals and facials upon both sides.

The occasional assertion that anæmia may thus permanently be maintained to a degree capable of doing more than evanescent good, in treating malignant disease of this region, we believe to be utterly without basis in fact, and say so after a prolonged search, conducted as stated in the preface to this essay. We at one time hoped that this was not true. A case of Prof. Joseph D. Bryant, which is well known in surgical annals, and often credited as a cure from this cause, was ground for this belief. But upon close inspection of the record, as Dr. Bryant prepared it, this hope falls shattered. The facts are as follows:—

Dr. J. D. Bryant in the summer of 1888 operated upon an orderly in Bellevue Hospital named William Burt. This man is still living. He had a large sarcoma of the naso-pharynx (variety not named), and Dr. Bryant tied both external carotids in order to try to starve it, and also to render safer the excision of his superior maxilla. These three steps were all performed at one sitting. From the hospital bedside notes the following is taken: "Dr. Bryant operated upon June 19, 1888. The right temporal was felt to pulsate two days later. On the seventh day both temporals could be felt beating over the zygoma, and on this day pulsation was noted in the left facial." Between thirty and sixty days later Dr. Bryant injected into the tumor an unknown quantity of a 10-per-cent. solution of carbolic acid (the menstruum not stated; evidently not water alone, as, in this, 5 per cent. is a saturated solution). The growth, as I understand from Dr. Bryant, became shrunken, and so remains, the time now being more than fourteen years.

It would seem a fair inference that, as the pulsation so promptly returned upon both sides, the carbolic injection, by

destroying large numbers of vessels in the mass, should be regarded as an important factor in the success. And Dr. Bryant has stated before the New York Surgical Society that double ligation has never in similar cases proved of permanent use, in his experience.

Elsewhere in the body this same method has been tried. Pryor, for example (*American Journal of Obstetrics*, volume xxxiii, pages 801 to 817, 1896), ligates the ovarian and the internal iliac arteries upon both sides for ineradicable cancer of the womb. Does cure follow? On the contrary, very recently Dr. Pryor has informed the essayist that while it is an excellent temporary means of relief, nothing more can be claimed for it. He has had no real cures, no permanent cessations of malignant development, and knows of none at the hands of others. Anastomosis is set up; the cancers are then better nourished and proceed to grow as before.

Nor is complete *excision* of the external carotid upon one side alone of much value. This is demonstrated by the case of Engel, Dr. Frank R. Phelps's patient, whose history is found in Chapter II. He refused repetition upon the second side, and his tongue, at first pale and shrunken as to its stump, soon resumed its ruddy hue, and grew rapidly again.

Advancing one step further in the line of thoroughness comes the ligation of one external carotid and the excision of the other, the latter upon the same side as the growth. Even this is utterly hopeless. There is the temporary shrinkage of the tumor, and this is admittedly maintained for a longer time than would be possible by double ligation, or by simply a single excision,—a very few months' instead of weeks' gain of life at most. But a case such as the initial one of the series (that of Busse, Dr. M. D. Lederman's patient) ought to be convincing. When his growth began to increase again, after a few months' shrinkage and respite, we did excision of his upper jaw, upon the ligated side. Never have we seen a more desperately bloody operation. However, we might naturally have

expected that no gain in anæmia would be attained at this operation, for the pulsation had returned to both temporals, facials, etc., at the time the sarcoma resumed its new lease of life.

Coming now in regular progression to the most radical of steps possible with the knife, we reach the essayist's plan whereby one and, after an interval for recuperation, the other superficial carotid is cut out from end to end, all of its eight branches being separately controlled.

At first thought, this sounds, indeed, a savage procedure; one hardly possible of accomplishment because of its severity; but the facts are that when adherent lymph-nodes or other adverse condition does not interfere, with experience it can be done upon one side in about twenty minutes, and remarkably easily and safely. And when performed upon both sides the pulse does not return to any of the branches of the superficial carotid system, even after years of time. This of itself speaks volumes for the gain in permanency of anæmia.

When first this idea was contemplated the author feared the patients might have to suffer, for their gain in longevity, through gangrene of the nose, the tongue, etc. But after carefully studying the anatomy it was found that by twenty-nine distinct routes blood by anastomosis could still enter this system of branches from outside systems (for a list of these see Chapter VI and also the colored frontispiece showing them schematically),—a small substitute, in point of number, for the hundreds of ways if a mere double ligation were done, but evidently enough to keep alive the normal flesh, at least. For, in reality, sloughing of it has never happened, either in the author's experience or that of other surgeons. Coldness and pallor of the face, lips, and tongue are regularly noted. This is capable of registration both in the mouth and upon the skin by means of a surface thermometer. But it is not long continued. Enough blood remains in circulation to keep alive the normal tissues; and neither does the malignant growth slough,

as a rule, though in two or three instances this has happened to a minor degree, and one is, of course, glad of it, in any measure at all. When soft, however, the new growth shrinks markedly, one-half to two-thirds disappearance being not uncommon. As we should expect, bony tumors do not show such obvious changes; and yet we claim a striking control even in subperiosteal sarcoma of the lower jaw—not of the giant-celled, but the round- and fusiform- celled varieties, than which no more hopeless condition in the world exists when treated by other means (save sometimes the x-rays and possibly at times antitoxins). Whether it be cut away or left in place, it has almost invariably the same dread ending, as shown by Butlin, for example, who alludes to its unhappy and discouraging statistics. Yet even in this disease it is possible to accomplish a real cure; that is, a permanent cessation of growth. And it is with deepest satisfaction that we chronicle in our histories herewith four such cases (Nos. 2, 3, 4, and 9, Chapter II), still alive after a period beyond Volkmann's danger-zone of three years, and with their hardened and somewhat shrunken tumor still in place. It has not disappeared, but it seems permanently scotched, and has, we may now perhaps say, ceased to be a constant menace to the patient's life.

In cases such as these there would seem to the essayist to be a fairly strong argument against the accuracy of the view held, and expressed quite recently by certain American pathologists, to the effect that the protozoa which they consider the cause of cancer are to be found regularly in the blood of such patients, everywhere, and early in their disease. Were this true, we should be at a loss to understand how any patient so affected could ever be cured by the knife. And yet they are at times so cured, as a matter of fact.

Even when both superficial carotids are wholly ablated we are not at the end of our resources in this line. At a later period (better so than at first, we think, except in the instance of the inferior dental branch) should any tendency to renewed

activity be displayed, at least seven more, moderately superficial, arteries may at one sitting be controlled by ligation, and doubtless with entire safety. This would have been done by the writer in more than one of his cancer cases had the patients given consent. Of the rather unintelligent class, so far in our limited experience being almost all ordinary ward cases in the public hospitals, they refused. The vessels referred to are:—

1. The occipital, just below the mastoid process.
2. The supra-orbital, at its exit from the foramen.
3. The infra-orbital, ditto.
4. The mental, ditto.
5. The facial, where it crosses the lower jaw-bone.
6. The superficial temporal, where it crosses the zygoma.
7. The frontal, at the inner angle above the orbit.

In the histories of the lower-jaw cases we called attention to a point that comes in appropriately for reference just here; and to its applications we attribute, in a measure, the permanency of the cure in these cases: that is, the exposure, through trephining the ramus of the lower jaw, or otherwise, of the inferior dental artery at a point about opposite the internal meatus of its canal, and its ligation here, as well as the separate tying of its chief branch, the mylo-hyoid, which is regularly given off at that point. This work is not at all difficult, and overcomes a serious peril; for, of the several anastomotic channels whereby the external-carotid system communicates with outside vascular systems, the chief are two: the *internal carotid,* through the internal maxillary and the superficial temporal, and the *subclavian,* in the neck, through the occipital. Now, the internal maxillary supplies, through the inferior dental artery, —quite a large one,—a chief supply of blood to that bone. And its mylo-hyoid branch nourishes the periosteum, as it grooves it; and also the adjacent parts of the floor of the mouth. It is plain, then, that even complete extirpation of the external carotid would not bring safety, through anæmia,

to the lower jaw, because the internal carotid could supply some blood to the whole internal maxillary nest of branches. But this trouble may be met and conquered in the way indicated; a simple surgical procedure, too.

Incidentally we may add that, having to expose the inferior dental nerve in order to uncover the artery of the same name, it seemed good tactics to excise a long piece of it, for then if the tumor should ever resume its fatal course, so far as the bone and adjacent floor of the mouth and front of the chin are concerned, the patient's sufferings would assuredly be much less than otherwise must be the case. This is upon the principle of warfare that a good general, even if he expects to whip the enemy, never should neglect to provide for his line of retreat.

We must here note that, for the reasons recently discussed (anastomosis in the orbit through the aid of the internal carotid), a malignant growth situated in the orbital region is not to be considered at all a hopeful one for the treatment by starvation.[1]

It was a satisfaction to the essayist to learn, through Dr. Wyeth's recent ingenious thought, of yet an additional and even more thorough way of obstructing the anastomotic channels; and as a means of supplementing the excision of the external carotid he believes that it may, when better understood and cautiously controlled, through further experimentation, take a certain place in our armamentarium. By reference to the terminal chapters of this essay a further discussion of it will be found.

We have now commented successively upon each of the seven advancing degrees of arterial obstruction. So far as ligation alone is concerned, the literature of the world has only afforded to our research thirteen authentic instances of its employment for control of malignancy in this region. Doubt-

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[1] Note Case XV, for example.

less many more have gone unhonored and unsung because of demonstrated uselessness.

We believe it to be unique in surgical annals to be able, as is done hereby, to adduce so large a number as eighty-three demonstrations,[1] of any new operation of whatsoever nature, upon the occasion of its official introduction to the profession. The delay of more than eight years before publishing has, of course, permitted this number to be accumulated.

So far as we can ascertain, this is the first time in history that *excision* of an artery, for any purpose, has been thought of or done, if we exclude that modern adaptation of the old operation of Philagrius of Macedon for the cure of aneurism, namely: excision of the sac, which necessarily cuts out a portion of the length of the artery. But this is performed for a wholly different reason. Of course, excision of considerable lengths of *veins* has many times been done, chiefly for the control of sepsis (*e.g.*, removal of the entire deep jugular when filled with a septic clot, as from mastoid infection) or for varicosity (*e.g.*, extirpation of the entire internal saphenous vein, or of a mass of such veins of the pampiniform plexus in curing varicocele).

If now we study the circumstances under which excision of the carotid may be performed, we find our cases naturally grouping themselves into three classes:—

I. Those where we excise both external carotids, and —to avoid deformity—leave a wholly operable tumor still in place, relying upon a closely and regularly maintained observation of the growth, for a period of years, to justify this; the patient agreeing positively to be faithful and to permit removal of the cancer or sarcoma in event of its renewed activity. By aid of our suggested needle test, in bone cases, one may early determine whether adjacent bone remains dense and healthy or not (see case of A. M. J., Chapter II, for exam-

[1] Over a hundred of them, including those detailed in the final chapter.

ple of the value of this test, commonly wholly neglected by surgeons; not even mentioned at all by Butlin). Also by use of plaster-of-Paris casts of the tumor, at definite intervals, for comparison as to size and shape, a resumption of growth could be promptly recognized.

It is possibly questionable whether, in cases of this mild or early type, it is justifiable to leave the growth and await events. In but one patient in these histories did we do so (G. W. White, Chapter II) and regretted it later, for he did not long keep his promise to report monthly.

Perhaps, if ever, this plan might be justified in the instance of a young woman with, for example, a sarcoma of the roof of the mouth or of the lower jaw; for thorough eradication would certainly result in distinct mutilation and deformity that not even careful dental prosthesis could wholly overcome, and hence probably a ruined life for the patient, as to prospects of marriage. Upon the other hand, the double carotid excision, where primary union is obtained, leaves such thread-like and almost invisible linear scars that it cannot, properly speaking, be classed as "mutilating" at all.

II. Cases where the malignant growth is operable, and consequently excised. Here we consider the double carotid excision such an excellent deterrent means as against recurrence that we would certainly advise it too. And since the carotid excision is so nearly devoid of risk *per se*, and, when done before the work upon the tumor, enables this to be accomplished almost bloodlessly,—hence without the chief cause of surgical shock,—we certainly feel that it is the part of wisdom to do it always.

III. The third class would comprise those whose cancer is already ineradicable, involving, for example, the base of the tongue and floor of the mouth and pharyngeal wall. Here we do nothing to the growth, wholly confining our effort to an endeavor to starve it by the double carotid excision; but, of course, during these procedures clearing away as thoroughly

as possible all visible or tangible lymph-nodes within the scope of the wound. Unfortunately, this third class is by far the commonest; and it must be remembered to the credit of this new measure of treatment that so far it has almost wholly been applied to the worst possible cases: ones considered utterly hopeless before reaching our hands. And if under such dread conditions the plan by starvation has accomplished so much as it has, to win our confidence, may we not hope for far better things from it when it is selected, not *in extremis*, but at an earlier period? It is possible to ascertain within a very few weeks of treatment of ineradicable growths by other known means (previously named), which sometimes fail and sometimes succeed, whether or not the tumor is being really benefited. And if not so, it follows that the starvation-plan should then be employed, not waiting until the patient is almost dying before making use of it.

So far as the material at the command of the essayist has permitted of definite opinions, it would seem clear that in sarcoma of any and all types we have a far more hopeful field for the treatment by anæmia than obtains in the instance of carcinoma of whatever variety. The only real cures which the essayist can claim—as based upon the customary Volkmann period of three years after operation without recurrence of activity—have been cases of sarcoma.

In carcinoma with very few exceptions there has been also a temporary shrinkage, often of very great degree; but no permanent cures as yet. And the only probable explanation of a failure to gain at least a striking temporary shriveling, such as in Dr. Munro's cases, Nos. 41 and 42 in our list, would seem to be an anomaly in the arterial supply whereby the external-carotid field obtains blood from some other source.

The longest period between the operation and death, in a cancer, has been somewhat over one year. It must never be forgotten, however, that the method has never as yet been tried at all early in a cancerous case so placed as

to be ineradicable. Considered simply as a palliative measure and *dernier ressort*, it has done good work and rendered less dreadful their deaths, as well as retarding the latter by some months.

It is pitiful to see the eagerness with which almost all the victims of this ghastly disease (cancer) hail the hope of even a brief extension of life. It may, in a sense, be questionable whether it is a kindness to lengthen their days and defer the inevitable end. Still, it is the duty of the surgeon not to take this view. It is his duty to add, even though only by hours, to the duration of life, if for any reason whatsoever the patient shall desire its continuance. And, finally, it is no less his duty to tell the patient the truth so far as we know it, raising no false hopes.

In conclusion: Upon what logical basis may the attempt to control malignancy by deprivation of blood be said to rest? And why is it so much more successful in sarcoma than in carcinoma?

To answer the former question, we should reply that cells of whatever nature must be fed abundantly in order to display activity; and, the more the food, the greater the activity. The malignant growths seem endowed with a relatively large number of blood-vessels as one of their striking characteristics, otherwise it would be hard to account for their usually great and prompt shrinkage in bulk after carotid excisions. They seem planned, and were developing until checked, upon a basis of greater blood-supply than the normal tissues receive. Perhaps this relatively better nutrition may largely account for their riotous activity and tremendous display of vigor of growth. Now, when this mass of billions of tiny living cells is suddenly reduced to feeding upon no more blood than the adjacent healthy tissues get, then, because of their aggregate bulk, each individual malignant cell may be supposed to get less nourishment than does each cell of the adjacent healthy flesh. Consequently we might naturally expect them to be more nearly

killed than are the latter. If, too, we assume that the hypothesis now held by Dr. Gaylord and perhaps a majority of pathologists is true,—namely: that it is the presence of protozoa in the flesh which excites the cells, whether epithelial, embryonic connective tissue, or giant-cells, into pernicious activity, whether by toxins, toxalbumins, and ptomaines the outcome of such microbes' living nutritive processes and death decompositions, or in some as yet unknown way,—then we must remember that these protozoa, too, are tiny animal cells, depending upon their daily food for their vigor and their very life. It can be understood that when almost starved these microbes will maintain a kind of hibernating existence, just as spores do for years or longer. They are presumably not really killed; and hence if, in months or years to come, some vessel or vessels shall gradually increase a very slight anastomotic connection into a greater one, the protozoa and their riotous dependents, the cells about them, will naturally rebegin to feel stronger and to wake up to renewed activity. Hence it behooves us to cut off all possible sources of blood-supply, short of killing the normal tissues thereby.

In reply to the second question: If we endeavor to explain upon anatomico-pathological grounds the apparent difference in results fairly to be claimed in favor of sarcoma as contrasted with cancer, this, upon reflection, seems quite natural and to be expected. For in sarcoma the growth depends for its extension chiefly upon vascularity. The lymphatics are commonly not involved; indeed, they often stop at the surface of the tumor and do not enter it; whereas the tunics of the blood-vessels are themselves composed largely of embryonic connective-tissue cells, in sarcoma.

In carcinoma extension occurs chiefly through the medium of the lymphatics, the blood-vessels not being at all usually themselves diseased. And it is plain that, even though shrunken and comparatively inactive from deprivation of blood, yet may the lymphatic current through the growth still continue, in a

measure—perhaps chiefly upon or very near its surface, where unaffected by atrophic compression. And hence there will remain the risk, even the likelihood, of an occasional extension of the cancer to the nearest chain of lymphatic nodes, and in time still farther onward.

It is for this reason that your essayist has, both upon theoretical and upon clinical grounds, a greater degree of hope for the future of the method by anæmia, as to permanency of cure (*i.e.*, remaining inactive), in the instance of sarcoma than in that of carcinoma. In justice to the starvation plan, as to the matter of metastasis, it should be observed that a patient who finally develops elsewhere—as in the brain, lungs, or liver—a secondary form of his disease, which kills him, may very probably have sown the deadly seed by blood- or lymph- current at a period *before* the carotid excisions were performed. The speed of such development would, of course, depend upon whether that seed fell upon fertile or stony ground, so to speak: upon the local conditions, in a word. It might conceivably only show itself in this new region of the body as a growing mass after months of comparative inactivity. Hence, only with a metastasis occurring a long time—perhaps six months—after the double carotid work, ought we to consider whether the shrunken and apparently inactive original tumor may, while in that state, have spread the disease. And in such late "secondary" development it is quite likely that the new tumor really has no filial relationship with the first, but both merely chanced to grow within the same man, who happens to have a favorable soil, so to speak.

The following case in the practice of Professor Pryor, of this city, bears directly upon this point:—

DR. R. H. M. DAWBARN. December 12, 1901.

MY DEAR DOCTOR:

I enclose a short memorandum.

E. W. W.; *æt.* 50. Round-cell sarcoma of the scalp anterior to the median line over the coronal suture and posteriorly attached to the

fascia for one inch, with a bunch of enlarged glands on right side of neck beneath the ear.

Operation, August 15, 1899. Removal of the enlarged glands in the neck. Ligation of both temporal arteries. Ligation of both supra-orbital arteries. Removal of the sarcoma down to the periosteum. The growth was round, and in diameter measured three and one-half inches. No recurrence at the seat of operation. Appendicitis, November, 1900. Operation for that disease; *during which the liver was found to be sarcomatous.*[1] Returned home. Death from sarcoma of the liver a year and a half after the first operation.

Yours sincerely,

WILLIAM R. PRYOR.

Here it will be noted that between the operation upon the sarcoma of the scalp and neck, and the recognition of sarcoma of the liver, was an interval of more than fourteen months. Now, had the primary operation been the author's starvation plan by excision of the external carotids, the tumor being too large to be removed, it is likely that some critic would have assumed that the liver development was an effect of which the shrunken growth above was the cause.

As to age, the carotid operations have now been performed successfully even at the extremes of old age and youth. The youngest recorded in this book was upon a baby of six months, at Bellevue Hospital, who recovered and was discharged "cured" after the double excision; and another was only eighteen months old, the operation being at St. Luke's Hospital, New York City, a double carotid excision, with recovery.

Thus far, these operations have been done almost without exception wholly in large and well-known metropolitan hospitals, such as Jefferson, Philadelphia; the Boston City Hospital; and in New York City, at Roosevelt, St. Luke's, the City Hospital, Bellevue, Mt. Sinai, New York Hospital, the German, the Polyclinic, and the following hospitals of Brooklyn, N. Y.: The Long Island College Hospital, Brooklyn, Kings County, Methodist Episcopal, and St. John's. It is the earnest hope of the essayist that it may also be tried thoroughly in pri-

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[1] Italics ours.

vate practice all over the civilized world. Except in New York, Philadelphia, Boston, and Atlanta, Ga., he has not known of its being used, as yet; and this is, of course, because it has thus far been but casually mentioned, and chiefly among those surgeons who have seen his patients exhibited at the New York Surgical Society.

The essayist will feel thankful to any physician who will be so kind as to report to him any case or cases within his own knowledge or experience, whether the result was a death or a recovery. Only in this way, by continuing a careful study of results, which will be published from time to time, can we be enabled to reach definite conclusions: impossible as yet because of the limited number of cases thus far subjected to the operation.

CHAPTER V.

TECHNIQUE OF OPERATION, INCLUDING THAT OF INJECTION.

TECHNIQUE OF OPERATION FOR EXCISION OF THE SUPERFICIAL (EXTERNAL) CAROTID.

THE patient's head must be well extended and his face held averted to the opposite side. A stout block should raise the shoulders, thus increasing the room for freedom of work. The incision should begin higher, of course, than for simple ligation of this artery. The cut runs from near the level of the tip of the ear downward, closely behind the angle of the jaw to the level of the middle of the larynx. The greater cornu of the hyoid bone may, as a rule, be considered the midpoint. At its beginning and end the cut lies over the artery in question; but the incision is curved rather sharply inward, its convexity being toward the median line of the neck. So that at the midpoint of the curve it is fully one and a half centimeters nearer this median line than ordinarily advised. The essayist is convinced that a gain, both in speed and safety of work, is accomplished thereby.

All danger lies toward the back—that is, away from the median line aforesaid; safety, toward the front of the wound, in carotid ligation. This is true whichever of the three carotids is meant.

Work now advances from the lower end upward. Usually the superior thyroid is the first branch of importance exposed. It is instantly recognized, being the only artery the course of which is definitely downward (though the lingual's is, too, just at its beginning, but not later). Tracing it back to its parent, we find the external carotid, around which a chromi-

cized catgut ligature is gently passed, but is not yet tightened. Carefully now the end of the common carotid is examined to make certain that it frankly bifurcates as usual. The branch of the common which gives off other branches should be the external carotid; also pressure upon it should stop the pulse in the facial and temporal arteries. The branch giving off none in the neck should be the internal carotid. *And yet the most common anomaly* (see Chapter VI) *is that in which no external carotid exists, all its branches being given off by the internal carotid on its way to the brain. This must not be forgotten.*

If no bifurcation of the common carotid is found, then we must trace the anomalous internal carotid up to the very base of the skull, tying twice and dividing each branch of it as reached, but avoiding injury or control of the internal carotid itself; for the outcome of ligature of the internal carotid is about as grave in prognosis as that of the common carotid, the chief causes of death being shock from severe brain-anæmia, or, if the patient survives this, softening of the brain. Wyeth's tables give the death-rate after tying the common carotid as 41 per cent.[1] Doubtless modern asepsis lowers this mortality; but nevertheless the risk is incomparably greater than would follow control or even extirpation of the external carotid.

Were the operator, mistaking the anomalous and branch-supplying internal carotid for the external, to inject it, while following Wyeth's suggestion (Chapter VIII), instant death would follow. Upon this point note Chapters VII and IX of this essay.

We have thus far followed the custom of writing external and internal carotid; but the terms are misnomers and misleading. At their origin from the common, the external carotid usually lies internal, and the internal carotid lies external, measuring from the median line of the neck. The

[1] "Transactions of the American Medical Association," volume xxix (1878).

words *superficial* and *deep* carotid would be more correct as to their ultimate distribution, since (in the main) the superficial supplies the superficial parts, and the deep, the deep parts of the head.[1]

We now tie twice and divide the superior thyroid between two fine chromicized catgut ligatures, doing the same in turn for each and every one of the other branches of the superficial carotid as reached. Of course, so far as practicable the ligation and division of these is accomplished well away from their parent, so as to sacrifice as much of each, with their occasional tiny and unnamed branches, as possible. This course seems particularly important in the case of the lingual. We always endeavor, in a tongue case, to expose its chief branch, the dorsalis linguæ, and tie this, too; this is given off, as a rule, immediately underneath the posterior tendon of the digastric.[2]

When the level of the twelfth cranial nerve is reached, and all branches of the artery but the terminal two have been controlled, the superficial carotid is itself tied twice and divided between. Up to this point the ligature thrown about it within the first three minutes of work (in favorable cases and skilled hands) was placed there only as a means of instant control should an accidental hæmorrhage occur above, during the steps just recounted. We do not ligate this artery at first, because then it collapses, with all its empty branches, to an insignificant caliber; and they can be much more easily recognized, dissected

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[1] Similarly, agreeing with many other members of the American Association of Anatomists, the essayist never refers to the external and internal abdominal ring of the inguinal canal, but to the superficial and deep rings; for the "external" ring is internal, and the "internal" ring external, when measured in distance from the median line of the body.

[2] Incidentally we may add, as of anatomical interest, that after some hundreds of demonstrations upon the dead body, in the course of operative surgery teaching, we feel certain that the descriptions ordinarily given are inaccurate, as to its direction at first. The lingual will commonly be found descending, and not the reverse, until it reaches the greater cornu of the hyoid bone. Not rarely the lingual and facial arise from a common trunk.

out, and followed up if distended with blood.[1] Next the distal end of the superficial carotid is made to take two successive dives. The first carries it beneath the transverse loop of the twelfth nerve. Again it is seized, and, disappearing beneath the conjoined stylo-hyoid and posterior belly of the digastric, it again is brought to the surface at a level above these two muscles.

The writer has for many years in all his arterial work discarded the aneurism needle, and even the blunt end of the bent silver probe, as a means of passing ligatures about arteries.

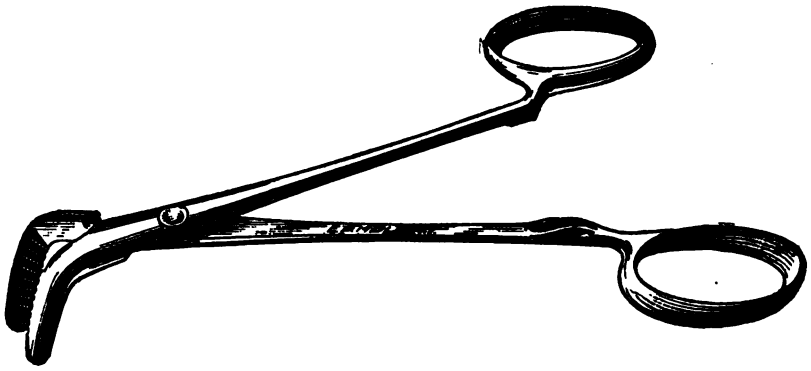

Fig. 2.—Author's Ligation Forceps.

Instead, he uses a pair of forceps, which in certain hospitals are known by his name. These are simply ordinary ,scissor-

[1] Having had one nearly fatal case from a slipped ligature here (not a secondary hæmorrhage, but an "intermediate" one, about an hour after the operation was completed), the writer, while adhering to the modern rule of tying *gently* to avoid rupturing any of the tunics, would urge that the point of severance be at least two centimeters distal to the tightened ligature; that, unless the superior thyroid be given off close to the carotid bifurcation, the artery be controlled between the bifurcation and this thyroid, for then the hammering heart cannot push or roll the catgut over the enlargement made by this branch. Or, finally, if the ligature upon the superficial carotid *must* rest distal to the superior thyroid, it may be well to fix it where placed by aid of a needle through adjacent connective tissue, before tightening the triply-tied knot. Or else, again, the suggestion of Senn may be adopted, and the carotid be tied at two places,—say, a centimeter apart,—and cut a safe distance distal to the second ligature.

handled artery forceps, but with the nose turned to very nearly a right-angle with the shaft. Being much blunter than either aneurism needle or probe, this instrument is safer. It cannot pierce an accompanying thin-walled vein. And this also is used in stretching a passage, by gently opening its jaws again and again, through which the artery-stump can presently be drawn with ease, first beneath, then above, the muscles just named.

The artery is now seen disappearing in the substance of the parotid gland. We must follow it up to its bifurcation when possible—which is not always the case—slipping a final ligature around the apex of the V made by its terminal branches. In doing this we avoid the knife, which might induce a facial paralysis by dividing some of the lower branches of the pes anserinus, or else, by cutting through some of the smaller ducts of the parotid gland, cause a salivary fistula. Instead, during gentle traction, steadying the arterial stump, an artery forceps passed alongside of and parallel to the carotid stretches a passage and frees the artery from surrounding cellular attachments. Finally the artery forceps catches it or its bifurcating branches at the highest point attainable, and a ligature is tightened, with some little trouble, just above this, after which the stump is severed as high as may be deemed safe.

It may not be amiss to allude here to the various structures injury of which is carefully to be avoided: the deep jugular and deep carotid and pneumogastric, of course. But less conspicuous are three nerves that might be seized or severed: the superior laryngeal, the pharyngeal branch of the pneumogastric, and at a high point the glosso-pharyngeal. All of these lie behind—*i.e.*, deeper than—the superficial carotid. With some carelessness the sympathetic also would be in jeopardy. In front, the hypoglossal nerve is in some danger of being seized and crushed by an artery forceps if any bleeding makes the field here temporarily obscure.

Rough handling is by all means to be condemned. The

writer knows no region where this would be more likely to be punished by shock. In dissecting away adherent lymph-nodes let us avoid vigorous traction upon these, meanwhile.

Regarding the veins: Their handling in the operation is of enough clinical interest to justify a brief space devoted to them. When the essayist first studied this whole topic it seemed to him of as prime importance that each and all veins, even the smallest, should be spared, as that all arteries and arterioles reachable should be tied off. Our object being a high degree of permanent anæmia, it seemed evident that it was as important to make easy the exit of any remaining blood as it was to make difficult the entrance of arterial blood. And accordingly, during all but the final few of his personal list of operations in the accompanying series, much time was devoted to this point. Occasionally an annoying nest of veins, anomalous in arrangement, was found covering in the various subdivisions of the superficial carotid. Often the large branch connecting the temporo-maxillary and the facial vein was in the way, and saved only by careful dissection.

Very recently the author's friend, Dr. A. T. Bristow, of Brooklyn, N. Y. (a well-known surgeon whose cases of this operation on the carotid are included in this volume), has convinced the essayist that the foregoing view is probably erroneous and the reverse of what is sound policy; and that in the future we may hope for even better results by tying off the veins as carefully and thoroughly as the arteries. This, too, adds greatly to the simplicity of the work, and by saving much time avoids one element of risk.

Dr. Bristow's argument, in effect, is that, although very possibly a greater degree of bloodlessness of the tumor may at first result from saving all the veins, yet in the long run—after months of time—this would not continue to be the case. On the contrary, that new capillary vessels will form with greater difficulty if they do not find venules and veins readily at hand to drain away their blood.

TECHNIQUE OF ARTERIAL OCCLUSION BY INJECTION.

INSTRUMENTS NEEDED.—A metal or glass *syringe* without leather packing, one that will tolerate sterilization by boiling, and of the capacity of, say, ten cubic centimeters. Its nozzle should be slender enough readily to enter the rubber tubing which will attach it to the cannula.

The cannula is of glass and is perhaps four to five centimeters in length. They are kept for sale by all dealers in goods used by physiologists. Several sizes should be ready. Perhaps a convenient one to enter the end of the superficial carotid would have a caliber of about the diameter of a knitting-needle. One end is beveled, the other is grooved transversely to hold the thread that binds it to a piece of sterile rubber tubing as short as possible, perhaps two to three centimeters. If much rubber tubing is used, it is a mistake, as it helps to cool the solution too soon, and also balloons. To avoid such stretching the essayist prefers a short piece of soft-rubber catheter, which is always of comparatively thick and strong rubber.

One pair of small, very sharp pointed, straight *scissors.* One smallest-size single-hook *tenaculum.*

An extremely slender-nosed long glass *pipette* with rubber nipple, like a medicine-dropper. (This may possibly be needed to remove a blood-clot from a vessel to be injected.)

The cannula and syringe with their short connecting bit of soft-rubber catheter are firmly fastened together with some kind of thread, such as linen, which stands boiling well. All these things are to be boiled, of course.

Other instruments are simply those for ordinary surgical work. In the final chapters will be found a discussion of the fluids for injection. The vessel containing the melted paraffin mixture floats in a much larger vessel of sterile hot water. By aid of a thermometer in this water an assistant detailed for the purpose maintains the injection fluid at the required heat. In

this water, too, rests the boiled syringe and cannula with its short tubing affixed and tied.

TECHNIQUE.—We will assume that, for reasons discussed upon page 132, in this chapter, the operator has decided that it is unwise to inject any branches other than the occipital and the terminal two. To inject the occipital he first exposes as usual the entire length of the superficial carotid, and proceeds as described earlier in this chapter, tying off twice, and dividing, all other branches of the superficial carotid, which is finally itself tied low down, but is not yet cut. It is next tied a second time just distal to its occipital branch. A transverse or oblique nick is now made with the sharp-pointed scissors in the wall of the superficial carotid at a point just proximal to the exit of the occipital. By aid of the tiny tenaculum the glass cannula is now passed through this nick and into the carotid, where it is tied firmly in place by a ligature thrown about it.[1]

The cannula and its short attached tubing and glass syringe are all full of the paraffin liquid, and until this moment have been kept at a temperature of 49° C. (120° F.), which is about as hot as the fingers can tolerate. If expeditious work be done, the injection can be completed before the temperature falls to 108° F., at which point the mixture turns white and solidifies.

The occipital is next ligated with catgut, and cut; although if solidification of the fluid has already taken place, ligation would seem unnecessary, and the plugged vessel need simply be divided.

To inject the terminal two branches (internal maxillary and superficial temporal), which come next in order, the following are the necessary steps (these cannot individually be

[1] In his earlier cases the author inserted the cannula directly into the occipital branch. But frequently its small size renders this difficult. It will be observed that the technique herein advised results in plugging the branch in question without difficulty, however small it may be.

reached for this purpose, as they lie high in the substance of the parotid gland): At a point as close to this gland as is convenient, the superficial carotid is nicked, and the cannula tied in. Of course, the termination of this vessel first receives the paraffin mixture; perhaps upon an average three centimeters of its length is filled before the fluid enters the bifurcation. After injection the carotid in question is tied off with catgut close to the gland—if the operator prefers to ligate it.

A point of distinct interest is the following: There is the possibility that because of the time needed during the preliminary steps, in each of these vessels the blood may clot; or, again, that clotting may result upon the instant, from contact of the blood with very hot paraffin (or some other chemical tried by another operator) as the injection is begun; and that in consequence of the thrombus so caused it will be impossible for the plastic material to enter the smaller branches among the nest of arterioles and capillaries which we are hoping to fill with it. Instead, it would enter the larger of the anastomotic branches with outside systems,—deep carotid or subclavian,—which would be objectionable; or perhaps from very effective clotting the material could hardly enter at all. So far as paraffin at 120° F. is concerned, we have proved that it does not cause contact-clotting. However, there are other causes; and the tendency varies within wide limits of time, in different people, even those in health. For a long time, too, after typhoid fever and a number of other diseases there is a striking tendency toward ready coagulation of the blood upon the slightest provocation, such as a brief stagnation of the current.

Considering all the foregoing, it is perhaps wise, upon the whole, to arm ourselves with a duplicate set of cannula, tubing, and syringe; and, filling these with warm sterile normal salt solution, to distend and flush out thoroughly by, say, 10 to 20 cubic centimeters of the saline solution, all the vessels and their branches which we presently intend to plug. (The ligature

about the superficial carotid near its origin is first to be tightened, of course.) With comparative leisure thereafter the operator may get ready for his paraffin technique, as heretofore described. The warm salt-water has driven out the blood from the vessels under treatment. In turn, the warm paraffin mixture will displace the saline solution.

This plan of avoiding any risk of failure by clotting adds but a very few minutes to the length of operation, and seems to the essayist worth while. Since it has but recently occurred to him, it was only employed in the last case recorded. The salt-water was introduced into the superficial carotid at a point not far above where it was ligated; at the point, indeed, at which later on this carotid was entirely severed, in process of completing its excision.

By reference to the colored frontispiece of this essay and its explanatory tables (pages 143-144), showing the twenty-nine ways by which the superficial (external) carotid system anastomoses with other systems, it will be noted that the occipital branch communicates through its subdivisions in five ways with the subclavian system; that the internal maxillary nest of branches presents nine such anastomoses, all being with the deep (internal) carotid system; and that the superficial temporal group has eight such communications, all belonging to the deep (internal) carotid system. These three branches — occipital, internal maxillary, and superficial temporal—are, it appears, thus responsible among them for twenty-two out of a total of twenty-nine recorded ways of anastomosis.

Plainly, then, obstruction of these three branches of the superficial carotid will carry the principle of treatment by extreme and permanent anæmia to its last limit of safety. We must not forget that the normal flesh requires *some* blood, from regular sources, upon which it can depend, in order to continue living; and less than seven such ways out of twenty-nine would invite disastrous sloughing. Of that, experience has convinced us. For though we record in this

essay proof that the twenty-two anastomoses aforesaid may be plugged on both sides without any sloughing of normal flesh (see case of Mrs. Henry E., for example, in final chapter), yet there are other instances recorded in that chapter where the skin over an inch or so of the cheek, also a small portion of the posterior edge of the ears, has undergone gangrene.

It would seem to be a question, then, whether plugging the terminal two carotid branches alone is not, as a rule, wiser; reserving the occipital obstruction, in addition, for those cases where the disease is fed distinctly by its vessels. This would seem to be the view of Dr. Bristow, whose injection-cases are recorded in the final chapter; for I observe that he injects the terminal two, but not the occipital.

It is worth noting that by keeping a finger firmly pressing the superficial temporal against the zygoma, during the carotid-end injection, we can leave five of its eight anastomoses with the deep carotid unobstructed, if for any reason this should be desired; for instance, if the tumor be nowhere near the temporal region, and we mean to obstruct the occipital also.

It is plainly impracticable to inject in its entirety either branch of the bifurcation separately, because they are buried in the parotid gland.

Now, in plugging first the end of the superficial carotid and then by the same stroke the internal maxillary and temporal, if too much paraffin be driven in the result is deadly. Moving, of course, in the direction of least resistance, it will not enter the capillaries when it can so readily gain entrance to larger vessels, namely: these abundant anastomoses. The continuation of the internal maxillary may be said to be the infra-orbital artery; and its chief anastomosis (by five branches), the ophthalmic. It is also unfortunate that *all* of the eight anastomoses of the superficial temporal are with this same vessel—the ophthalmic. Inject too much paraffin or other permanent obstructive material, and the arteria centralis retinæ

(from the ophthalmic) will be filled—blindness. Continue the injection but a moment longer and the liquid-paraffin current, further entering the deep carotid system through the ophthalmic and numerous other branches, as already mentioned, will cause death. From this cause, as shown in Chapter VII (pages 146 *et seq.*), the essayist has repeatedly had opportunity to observe, during his experimental work upon dogs, a fatal ending; and the autopsy has verified the explanation as just given.

As to the occipital branch, by careful study it will be noted that there are just two anastomoses with it which may conceivably (if abnormally free) prove a source of danger from plugging. One of these is the communication between the deep branch of the princeps cervicis and the vertebral; the second, also with the vertebral, through the "communicating" branch of the occipital, is only given by Morris. Under ordinary conditions neither of these routes, presumably, is really a danger. But if the paraffin *should* enter the vertebrals, plugging branches of the basilar, it would be an especially disastrous region to attack: that of the respiratory center, etc.

It follows, then, from the foregoing study of the anatomy of all three of these branches, that Wyeth's suggestion is exceedingly dangerous in inexperienced hands; and would perhaps hardly be justifiable at all as an expedient were we not fighting an enemy so dread, an enemy that grants no quarter, and compels us to try any weapon whatsoever that offers a chance of usefulness. Accordingly the essayist has made a very careful study, first upon dogs, as indicated in Chapter VII, and subsequently upon many of the human cadavers used in his course in operative surgery. Only after the latter did he feel himself justified in attempting upon patients the injection plan to supplement the carotid excision. Plainly, safety depends wholly upon properly estimating the amount of the paraffin mixture to be injected into the superficial carotid bifurcation; also into the occipital branch. At first the essayist estimated the safe limit wrongly, as he is

now convinced, being deceived by his findings after a series of dissections of human bodies. At first he assumed that 6 to 8 cubic centimeters (3iss-ij) could safely be used in the carotid end; and, indeed, even as large a dose as this has been tried upon the living patient very early in this work, without ill results, by Bristow and others, as well as by himself.[1] However, a little later, an instance upon the cadaver (male, middle aged, medium size and weight) was observed, where 45 minims injected close to the parotid gland not only filled the carotid end and both bifurcating branches and their subdivisions, but also distinctly entered for a short distance the deep carotid system within the orbit. This may be, and I think is, a great rarity. Nevertheless it causes the essayist to recommend that not more than 2 cubic centimeters (30 minims) be employed in the carotid, very near to where it disappears within the parotid gland, and perhaps only two-thirds of this amount, if the finger upon the zygoma is used to control a portion of the length and branches of the superficial temporal.

As for the occipital, so far as experiment and practical usage serve, it would seem entirely safe to inject as much as, and perhaps more than, in the case of the carotid. Although there is the vertebral anastomosis, it is very small. And upon the cadaver no danger has developed from injecting 3ij. Still, as there is the possibility of meeting an exceptionally free connection with the vertebral at any time, I prefer to advise using only 3ss here, as with the carotid system.

A point of interest for those who may wish to repeat our experiments and compare our results with their own is that it is not practicable to inject the hot paraffin mixture into cadaveric vessels. The chill of death so quickly reduces the temperature of the fluid that, even when started at a temperature very many degrees higher than advised upon the living patient, it will solidify and turn white before the syringe can inject the

[1] See, for example, page 170.

desired amount. It would be necessary to heat the cadaver up to a temperature normal within the living body to make this injection practicable. Instead, therefore, of using paraffin, the test was always made in these experiments upon the cadaver with a thin cream of plaster of Paris, colored green with chlorophyll or blue with methylene blue. Since it is almost always the case that after death the arteries and arterioles promptly become emptied of blood into the venous system, no clots were present to interfere to any serious degree with the tests.

CHAPTER VI.

Anatomical, Including the Anastomoses, Varieties of Principal Anomalies, etc.

Superficial (or External) Carotid.[1]

Anterior Branches.

Superior Thyroid: Anastomoses with fellow and inferior thyroid of the thyroid axis; also with thyroidea ima, if present (Deaver)	*Hyoid:*	Anastomoses with fellow; also (Morris) with hyoid of lingual artery.
	Superficial descending:	No named anastomoses.
	Superior laryngeal:	Anastomoses with fellow.
	Crico-thyroid:	Anastomoses with fellow.
Lingual:	*Hyoid:*	Anastomoses with fellow; also (Morris, Quain) with hyoid of superior thyroid.
	Dorsalis linguæ:	Anastomoses with fellow; also (Morris) with other facial and tonsillar arteries.
	Sublingual:	Anastomoses with fellow; also (Morris) with submental branch of facial, and inferior dental.
	Ranine:	Anastomoses with fellow (but Hyrtl disputes this).[2]
Facial:	*Anterior, or ascending palatine:*	Anastomoses with tonsillar and post-palatine branch of internal maxillary; also (Morris) with ascending pharyngeal.

[1] Anastomoses according to Gray's "Anatomy" unless otherwise specified.
[2] The essayist has many times had opportunity to convince himself that, at least as a rule, Hyrtl is mistaken in this.

FACIAL (*Concluded*)	*Tonsillar:*	Anastomoses (Morris, Quain) with tonsillar branch of ascending palatine and other tonsillar arteries.
	Submaxillary:	No named anastomoses.
	Submental:	Anastomoses with inferior labial and mental; also (Morris, Quain) with sublingual.
	Muscular:	No named anastomoses that are regular ones in neck. On face, Morris specifies masseteric and buccal branches.
	Inferior labial:	Anastomoses with inferior coronary and submental, and mental branch of inferior dental.
	Inferior coronary:	Anastomoses with inferior labial and mental branch of the inferior dental and its fellow.
	Superior coronary:	Anastomoses with fellow.
	Lateralis nasi:	Anastomoses with fellow, nasal branch of ophthalmic, inferior artery of septum, artery of the ala, and infra-orbital.
	Angular:	Anastomoses with infra-orbital, nasal branch of the ophthalmic, and inferior branch of palpebral.

POSTERIOR BRANCHES.

OCCIPITAL:	*Communicating branch:*	Anastomoses with vertebral (Morris).
	Muscular:	No named anastomoses.
	Sterno-mastoid:	No named anastomoses.
	Auricular:	No named anastomoses.
	Meningeal (posterior):	No named anastomoses.
	Arteria princeps cervicis:	Anastomoses with superficial cervical, a branch of the transversalis colli vertebral; and deep cervical artery, a branch of the superior intercostal; also (Deaver) with ascending cervical.
	Cranial:	Anastomoses with fellow, post-auricular, and temporal arteries.
POSTERIOR AURICULAR: Anastomoses with posterior division of the temporal and occipital	*Parotid:*	Anastomoses (Morris) with other parotid arteries.
	Stylo-mastoid:	Anastomoses with petrosal branch of the middle meningeal, and tympanic of the internal carotid.
	Auricular:	Anastomoses with anterior auricular of the superficial temporal; also (Morris) with posterior branch of superficial temporal.
	Mastoid:	Anastomoses with occipital.
	Tympanic:	Anastomoses (Morris; Gray, under heading of "Tympanum") with other five tympanic arteries.

ASCENDING BRANCH.

ASCENDING PHARYNGEAL: Anastomoses (Morris) with ascending palatine; also (Deaver) with ascending cervical from inferior thyroid	*Prevertebral:*	Anastomoses with ascending cervical.
	Pharyngeal:	Anastomoses (Morris and Quain) with superior thyroid.
	Palatine:	No named anastomoses (Morris).
	Tympanic:	Anastomoses (Morris) in the tympanum with the other tympanic arteries.
	Meningeal:	No named anastomoses. Supplies dura mater.

TERMINAL.

SUPERFICIAL TEMPORAL:	*Anterior temporal:*	Anastomoses with supra-orbital and frontal, also (Morris) with supratrochlear, all of them from the ophthalmic; and with its fellow.
	Posterior temporal:	Anastomoses with fellow, posterior auricular, and occipital.
	Transverse facial:	Anastomoses with facial, supra-orbital, masseteric, lacrymal, inferior palpebral; also (Morris, Quain) with buccal.
	Middle temporal:	Anastomoses with deep temporal of internal maxillary lacrymal, and superior palpebral of the ophthalmic.
	Anterior auricular:	Anastomoses with posterior auricular.

INTERNAL MAXILLARY.

FIRST OR MAXILLARY PORTION :	*Tympanic (anterior) :*	Anastomoses with vidian and tympanic of internal carotid; also (Quain) with stylo-mastoid.
	Middle meningeal :	Anastomoses with fellow, anterior and posterior meningeal, ophthalmic branches of temporal and posterior auricular, and arteriæ receptaculi; also Quain, Morris) with terminal branch of the stylo-mastoid.
	Inferior dental :	Anastomoses with fellow, submental, inferior labial, and inferior coronary; also (Morris) with sublingual.
	Small meningeal :	No named anastomoses.
SECOND OR PTERYGOID PORTION :	*Deep temporal :*	Anastomoses with other temporal and lacrymal also Morris with transverse facial.
	Pterygoid :	No named anastomoses.
	Masseteric :	Anastomoses with masseteric branch of facial and transverse facial.
	Buccal :	Anastomoses with facial also Morris) with transverse facial and infra-orbital.
THIRD OR SPHENO-MAXILLARY PORTION :	*Alveolar :*	No named anastomoses.
	Infra-orbital :	Anastomoses with nasal branches of the ophthalmic, angular of facial, transverse facial, and buccal; also (Morris) with coronary; and with lacrymal of the ophthalmic.

THIRD OR SPHENO-MAXILLARY PORTION (*Continued*):	*Descending palatine:*	Anastomoses with naso-palatine and ascending palatine.
	Vidian:	Anastomoses with anterior tympanic; also (Morris) with ascending pharyngeal and pterygo-palatine.
	Pterygo-palatine:	No named anastomoses.
	Spheno-palatine:	Anastomoses with descending palatine, and posterior ethmoid from ophthalmic; also (Morris) with anterior palatine.

ANOMALIES OF THE EXTERNAL CAROTID.[1]

The commonest anomaly of the external carotid in the human subject (the writer finds the same to be the *rule*, not an exception, in dogs) is the following: That the external carotid may be absent, the branches of that artery arising from the common carotid artery, which last continues upward without bifurcation as the internal carotid artery.

It may be a short trunk, or arise at a higher or lower level than normally. Two or more branches—as the superior thyroid, lingual, and facial arteries—may arise from a common trunk. Some of its lower branches may arise from the common carotid artery. Occasionally it gives origin to additional branches, viz.: the superior laryngeal and middle sterno-mastoid branches of the superior thyroid artery; the ascending palatine and tonsillar branches of the facial artery; the superior sterno-mastoid, a branch of the occipital artery; and the transverse facial branch of the superficial temporal.

The external carotid may arise from the arch of the aorta. There is no artery more frequently the subject of anomalies than the one studied in this essay. All of those, however,

[1] According to Deaver, Quain, and Gerrish.

though interesting, are practically unimportant except the first mentioned. If this anomaly is not recognized by the operator, ligation, followed by excision of the only carotid would be performed, and would jeopard the patient by anæmia of the brain; and, if the paraffin or other injection plan of starving the growth is being tried, there would be prompt death from embolism of the vessels of the respiratory center at the base of the brain.

A LIST OF THE ANASTOMOSES, TWENTY-NINE IN NUMBER, BETWEEN THE BRANCHES OF THE SUPERFICIAL (EXTERNAL) CAROTID SYSTEM AND OTHER SYSTEMS.[1]

I. II.	Superior thyroid (*f*)	with	the inferior thyroid (*1*) of the thyroid axis (*b*). thyroidea ima (*e*), when present.
III.	Prevertebral branch (*6*) of the ascending pharyngeal (*h*)	with	the ascending cervical branch (*5*) of the inferior thyroid (*1*), of the thyroid axis (*b*).
IV.	Lateralis nasi branch (*9*) of the facial (*i*)	with	the nasal branch (*25*) of the ophthalmic (*r*).
V. VI.	Angular branch (*10*) of the facial (*i*)	with	the nasal branch (*25*) of the ophthalmic (*r*); also inferior palpebral branch (*24*) of the ophthalmic (*r*).
VII.	Communicating branch (*7*) of the occipital (*j*)	with	the vertebral branch (*c*) of the subclavian (*Sb. Cl.*).
VIII. IX. X. XI.	Arteria princeps cervicis branch (*8*) of the occipital (*j*)	with	the superficial cervical branch (*3*) of the transversalis colli (*2*). deep cervical branch (*4*) of the superior intercostal (*a*). ascending cervical branch (*5*) of the inferior thyroid (*1*). vertebral (*c*).

[1] The letters and numerals are explanatory of the colored frontispiece. The large arteries are indicated by capital letters, their main branches by smaller letters, their final arterioles by Arabic numerals, and the twenty-nine anastomoses by Roman numerals.

XII.	Stylo-mastoid branch (*11*) of the posterior auricular (*k*)	with	the tympanic branch (*n*) of the deep carotid (*D*).
XIII. XIV. XV.	Anterior temporal branch (*19*) of the superficial temporal (*m*)	with	three branches of the ophthalmic (*r*): *i.e.*, supra-orbital (*20*), frontal (*21*), and trochlear (*22*).
XVI. XVII. XVIII.	Transverse facial branch (*17*) of the superficial temporal (*m*)	with	three branches of the ophthalmic (*r*): *i.e.*, supra-orbital (*20*), lacrymal (*26*), and inferior palpebral (*24*).
XIX. XX.	Middle temporal branch (*18*) of the superficial temporal (*m*)	with	two branches of the ophthalmic (*r*): *i.e.*, lacrymal (*26*) and superior palpebral (*23*).
XXI.	Tympanic (anterior) branch (*12*) of the internal maxillary (*l*)	with	the tympanic branch (*n*) of the deep carotid (*D*).
XXII. XXIII. XXIV. XXV.	Middle meningeal branch (*13*) of the internal maxillary (*l*)	with	the anterior meningeal (*o*); posterior meningeal (*p*); and arteriæ receptaculi (*q*); ophthalmic branches, especially the lacrymal (*26*).
XXVI.	Anterior deep temporal branch (*14*) of the internal maxillary (*l*)	with	the lacrymal branch (*26*) of the ophthalmic (*r*).
XXVII. XXVIII.	Infra-orbital branch (*16*) of the internal maxillary (*l*)	with	two branches of the ophthalmic (*r*): *i.e.*, lacrymal (*26*) and nasal (*25*).
XXIX.	Spheno-palatine branch (*15*) of the internal maxillary (*l*)	with	the posterior ethmoid branch (*27*) of the ophthalmic (*r*).

From the foregoing it will be noted that 7 of the 8 branches of the superficial carotid artery anastomose with other arterial systems, the deep carotid or the subclavian, or the innominate, the lingual branch forming the only exception, and consequently being indicated only by a stump *(g)* in the colored plate. The total number of such outside anastomoses, as contrasted with inside ones—*i.e.*, the branches of the

superficial carotid with each other—is 29. Of this number the deep carotid furnishes 21; the subclavian, 7; the innominate, 1.

The chief channels for such communication, and in consequence our main source of danger from redevelopment of blood-supply, are three, viz.: the occipital and the terminal two,—*i.e.*, the internal maxillary and the superficial temporal. The latter two meet and mingle with the deep carotid circulation in 17 ways; the occipital with the subclavian in 5 ways. Since these three branches of the superficial carotid's eight account, then, for 22 out of a total of 29 outside anastomoses, it is plain that they should receive our particular care; and that, if the injection-plan is to be used to supplement vascular excision for starvation, these are the branches which require it at our hands. But the normal flesh requires *some* blood-supply in order to live, and the remaining ways must assuredly not be blocked.

It is believed that the colored frontispiece, in which all these points are exhibited schematically, will simplify for the reader of these pages the recognition of the foregoing anatomical points.

CHAPTER VII.

Wyeth's Suggestion. The Essayist's Studies upon Dogs Resulting from it.

During the spring of the year 1901 Dr. J. A. Wyeth, in discussing with the essayist the topic of external-carotid excision as a means of opposing the advancement of sarcoma and cancer, made a suggestion which will be found elaborated by himself in Chapter VIII of this work. This was to aid the good fight for starvation of the enemy through depriving him of his commissariat, by plugging the superficial carotid and its branches with some plastic material,—wax, for instance,—injected in a liquid state and allowed to cool, or else by intra-arterial injection of boiling water, to cause obliterating endarteritis.

The idea appealed to the writer at once as being one deserving at least of careful thought and of experimentation. Dr. Wyeth proceeded to test it at the Polyclinic, in two animals, though not upon any vessel of the carotid system; and the essayist made arrangements whereby, through the courtesy and by the help of Dr. John G. Curtis, Professor of Physiology in the University of Columbia, it could be studied upon dogs, in the carotid system exclusively.

It was the writer's intention, if it proved sufficiently safe and practicable in the dog, to try it in appropriate cases upon patients, particularly to obstruct by some such means the internal maxillary and superficial temporal nests of branches, so dangerous because of their anastomosing with branches of the internal carotid.

A large part of such time as the essayist, during that season of 1901, could devote to scientific research was spent

in this way; most actively so during the month of May, in which, ably assisted by Dr. Malcolm Goodridge, of New York, he tried the intra-arterial injection plan upon thirteen dogs, Dr. Goodridge also taking careful and detailed notes.

As to the material used, it was at first bees-wax melted in equal parts with white paraffin; but, finding this set too quickly into the solid form, a change was made on and after the third experiment to a mixture of white paraffin, 1 part; white vaselin, 9 parts: a proportion which solidifies at about 108° F.[1] The technique will be found under that heading (Chapter V, page 123), and a discussion of the subject of paraffin *versus* wax and also *versus* boiling water at the end of the present chapter.

In all instances the dogs received first a hypodermic injection of morphine,—about a decigramme, upon the average,—and fifteen minutes later were anæsthetized with ether. We feel sure they were spared all suffering, so far as the operation is concerned.

The first thing the operator did was to kill unintentionally three dogs in succession by injecting the artery which was thought to be the external carotid, but was, in fact, the internal, it giving off the branches of an external carotid about as in the human subject. A brief description of the result in one will apply to all of these:—

"EXPERIMENT III. — Black, smooth-haired, male dog; weight, 14.5 kilogrammes; received 0.09 gramme of morphine, followed by ether. The artery taken for the external carotid, because of its typical course and branches as per Howell, was nicked, and the warmed glass cannula inserted and tied in place, pointing distally. Promptly the pure paraffin mixture, now first used by us, was injected, with hot syringe; as nearly as could be estimated, the dog received, at a temperature of

[1] Had a melting-point lower—say, 104-105° F.—been arranged by using relatively more vaselin, it is conceivable that during a very high fever at some later period of life the mixture, becoming fluid from the body-heat, might be swept out of these vessels, leaving them empty.

50° C., about 8 cubic centimeters. Immediately he straightened out (tonic contraction of the limbs) and uttered two or three sharp yelps, although fully anæsthetized at the time. After several gasping inspirations breathing ceased. The heart at first became very rapid (immediately following the paraffin injection); then irregular, weak, and intermittent; then slow as well; and finally stopped, about four to five minutes after cessation of respiration. Dog died of respiratory paralysis, in spite of prompt use of Nélaton's position. Artificial respiration by aid of Hoyt's new apparatus, which was right at hand, with Hoyt to manage it, and hypodermic injections of strychnine and atropine, were unavailing.

"Post-mortem examination of the head and neck showed that it was the *internal* carotid which had been injected, no artery corresponding to the external carotid of man being present. The paraffin not only plugged the internal carotid solidly, but filled the circle of Willis at the base of the brain, and all its tributaries.

"Every artery of the medulla was obstructed with the paraffin. It had even passed across the median line into the arterioles of the opposite side."

Upon further study of the anatomy of the dog in the region of the neck a surprising discrepancy is observable between the statements in standard works. We had been following the "Dissection of the Dog," by W. H. Howell, A.B., Ph.D., Associate in Biology at Johns Hopkins, published in New York, 1888. This book, on page 53, illustrates the internal carotid as a small branch given off between the superior thyroid and occipital. On page 58 the author says:—

"*The internal carotid:* at the level of the larynx[1] the common carotid divides into the internal and external carotids. The former is much the smaller, and passes to the base of the skull.

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[1] At the level of the *top* of the larynx, is meant, presumably.

"*The external carotid* seems to be the direct continuation of the common carotid." It is described as giving off all the branches in the neck named in the human anatomy; and none of these is described as being given off from the internal carotid.

Upon the other hand, note the following, from the "Anatomie des Hunds," by Drs. Ellenberger and H. Baum, published in Berlin, 1891, page 376: "Die A. Carotis ext. tritt als Fortsetzung der Carotis communis," etc.; also, page 371: "Die A. Carotis interna ist beim Hunde nur Schwach und hochstens von gleicher Stärke wie die A. occipitalis."

According to our experiments, in which, for the purpose of trying to settle such a contradiction, the essayist dissected the necks of nine dogs in succession, the German anatomists are right and Dr. Howell wrong.

In the essayist's opinion, the common carotid of the dog cannot properly be said to bifurcate at all. The internal carotid is its main continuation; and, beginning at the level of the top of the larynx, are given off from the main artery, whether this be still considered common or internal carotid, all the branches usually contributed by the external carotid. The latter is quite a small artery—when present at all; and its place seems often to be taken by one or another branch given off from the main continuation of the carotids.

No branch of the latter averages, I find, so large as does the lingual, which was one reason that, after finding it impracticable to experiment upon the external carotid of dogs, to compare results with the same vessel in man, we changed to injecting the lingual, another reason being that any nutritive result of vascular obstruction can be so readily studied in the tongue.

At the request of the essayist, Dr. H. E. Hale, Assistant Demonstrator of Anatomy at Columbia University Medical School, made a series of dissections of dogs' necks in order to verify or contradict the view just quoted, the truth alone being

wanted. Dr. Hale reports: "The arrangement of the carotids in the dog I find to be quite constant. With one exception, they all presented the following arrangement: A *primitive carotid,* extending through the neck to the base of skull; upon entering the skull it becomes the *internal carotid.* There is no external carotid, in the usual acceptation of that term. The primitive carotid has numerous branches of distribution. The lowest is the superior thyroid, which comes off opposite the cricoid cartilage; a little above from its inner aspect arises a small branch, which appears to be an ascending meningeal. It keeps very close to the vagus nerve. Above this branch, in the following order, come lingual, facial, occipital, and temporal."

The reason that so much space as a page or so is devoted in this essay to straightening out this contradiction is that it is a curious fact, and well worth bearing in mind, that the condition which we have just described as being the customary and regular one in dogs is also *the one found in the commonest form of anomaly in the human subject* (Deaver's "Surgical Anatomy," volume ii, page 187). And, if the injection plan of attaining permanent anæmia shall ever come into vogue in the profession, this anomaly presents a peril; for the unwary operator, proceeding to inject the carotid which is giving off branches, would promptly kill his patient, just as the writer killed the first three dogs described above. The only safety is found, either for this purpose or while excising the superficial carotid, in making sure of the presence of a real bifurcation before proceeding with the operation. This is considered so important that it has been several times mentioned in this essay.

To describe briefly our results obtained by injecting the paraffin mixture into the lingual arteries of a considerable number of dogs whose tongues were subsequently excised and dissected by Dr. Hale and then preserved for the writer's inspection: In all instances considerable irritation resulted, and,

in a few, distinct gangrene, in small patches. But in none did any large part of the tongue slough away. The injected tongues seemed during life to be, perhaps from temporary swelling, perhaps also from rigidity due to the hardened plastic injection, under poor control; and this would certainly threaten a *schluckpneumonie,* because the epiglottis could but imperfectly be folded down upon the larynx in the act of swallowing. These dogs were fed upon meat. A fluid food would probably have entered the air-passages and induced trouble there, as just suggested. The animals bit their tongues at times while eating; and it may perhaps also be the case that to sepsis so produced occasional sloughing at the edge or top on the injected side was due.

Although plastic injection after sufficient study as to amount and as to ways and means may come into use for vessels such as the occipital and internal maxillary and superficial temporal, it seems plain to the essayist that, for reasons discussed in Chapter V, pages 132-133, it will never do for use in filling the entire superficial carotid system, as suggested by Dr. Wyeth. We will have to avoid using it in arteries supplying regions where free motion is essential, such as the tongue and the larynx, unless, as to the larynx, the patient is willing utterly to lose his voice, in the doubtful hope of a greater benefit than ligation of the thyroid vessels offers in conjunction with the other ligations. As to the ascending pharyngeal, it is commonly too small for practical injection work. Injecting the facial and the posterior auricular will be followed by sloughing of part of the face and of the ear, respectively.

Regarding the question as to what substance for injection is probably best for permanent retention in the vessels, the writer at first intended to try melted wax, instead of paraffin, and decided against it because it is assuredly true that wax is slowly absorbed in the body and disappears. And it is conceivable that by such a process in time the plugged vessels might again be open. The use of bees-wax to control bleeding from

bone is a very old device. The writer, for instance, knows personally of an old surgeon of the war between our States who carried a lump of this in his operating kit, and used it time and again as stated.

"Horsley's antiseptic wax" is, of course, now well known to surgeons. This preparation consists of:—

Bees-wax	7 parts.
Almond-oil	1 part.
Salicylic acid	1 part.

Professor Keen introduced it into Jefferson Hospital, Philadelphia, many years ago; and recommended it, rubbed into diploë or other cancellous tissues, to arrest bone-bleeding.

The essayist has for years used bees-wax in this way: He procures modeler's wax, which comes in white sheets and contains enough Venice turpentine to render it less apt to be brittle and crumble when only slightly softened by heat. This is placed in a large urinary test-tube, is melted and sterilized by heat, and when almost hard is used for the purpose indicated. In at least two instances within his recollection, during a second operation close to or in contact with the diploë-region, the pores of which had been filled with this, rubbed into them with the finger, he has exposed this bone purposely, and ascertained that after a period of a few months, certainly, and perhaps in less time, *all the wax has disappeared.* Paraffin will doubtless prove more permanent, and is consequently chosen for injection work.

Regarding Dr. Wyeth's suggestion to employ boiling water within the artery, to cause obliterating endarteritis, the essayist would state that he has not used it. Dr. Wyeth has experimented upon a dog with it at the Polyclinic, and thinks well of it, though in both limbs so treated gangrene developed (Chapter VIII, page 157). Upon the other hand, Professor Curtis, of the Columbia University Physiological Department, expressed to the essayist his opinion that there seemed no way in which the degree of heat could be so controlled and regulated

that it would not risk inducing multiple thromboses in the veins, and perhaps embolism in consequence, with fatal results. This, plus the great likelihood of gangrene of the meninges in consequence (page 157), if the patient lived long enough for it to occur, ought to suffice to bar out this plan.

Dr. Wyeth's own case of angiomatous condition treated by injection of boiling water (page 158) is really not an instance in point at all as bearing upon the topic in hand; for he did not inject the boiling water into the lumen of an artery, but into the cellular tissues of the growth, thereby clotting the blood of those of its vessels near enough to feel the effects of intense heat.

To the essayist it would seem that this idea, thus carried out, of clotting by intracellular injection, is probably quite safe, but is not at all new, except as to the fluid used. It ought to be valuable for angiomas.

Report for the Microscopical Examination of Dogs' Tongues[1] Submitted for Section-cutting.

By Dr. F. M. Jeffries, Pathologist.

The most striking change noticeable in all three tongues is the extensive fat-replacement. So extensive is this in one tongue that fat appears as the predominating tissue. This fat-replacement is at the expense of muscular tissue. There has been an extensive atrophy, both simple and numerical, of the muscular tissue noticeable in sections prepared from the tip as well as from the base.

The microscopical manifestations of muscular atrophy are, in a measure, peculiar as regards the distribution. While in some areas the fibers are one and all atrophied, in others the atrophied and normal fibers are arranged in alternating groups

[1] The lingual artery injected with the paraffin mixture advised on page 147. Animal killed after three days.

or bundles, and still in others fairly large areas appear to have been unaffected.

A marked feature of the muscular atrophy is an extensive pigmentation. Each fiber exhibiting atrophic changes contains minute, brown granules in such numbers that a brown pigmentation is imparted to that fiber.

Fat generally displaces the lost muscular fibers; but in the area around the main arterial branch there has been an

Fig. 3.—Appearance of Dog's Tongue After Injection of Hot Paraffin[1] into the Lingual Artery. (Photograph by Dr. Buxton. × 7 1/2.)

extensive fibrosis, and in this area the fat does not appear. On one of the tongues a few small ulcerations were observed on the upper surface near the margin. Sections through one of these demonstrate an extensive fibrosis beneath the ulcer extending to a considerable depth, although in the tissues adjoining the ulcer no fibrous change is manifest.

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[1] At 49° C. Not hot enough to coagulate. See footnote 2 on page 157.

Many nerve-bundles exhibit interstitial neuritis and degenerative changes, but the majority of them appear quite normal.

One set of sections includes a group of mucous glands which have so markedly atrophied that, were it not for their fairly normal ducts, one might be at a loss to determine their nature.

With the exception of the areas where ulceration occurred, the epithelium appears quite normal.

The main arterial branch in each case is markedly atrophied, and in one of them a beginning necrosis is manifest. The smaller branches are normal, as a rule.

The veins are engorged with blood, and are normal as far as could be determined.

CHAPTER VIII.

The Obliteration of Blood-vessels by Injection.

STATEMENT BY PROF. J. A. WYETH.

For a number of years I have observed the encouraging results which have followed the work of Professor Dawbarn in his operation of excision of the external-carotid arteries and their branches for the purpose of cutting off the blood-supply to inoperable tumors situated in the naso-pharynx and elsewhere. This operation, no matter how expert the surgeon, is necessarily tedious and prolonged. It occurred to me that the starvation of these neoplasms might be obtained by injecting into the main trunk of the external carotid some liquid substance which would either produce an obliterating endarteritis by irritation or would mechanically plug the larger arteries and arterioles leading toward the growth.

In January of this year (1901) I made some experiments upon dogs, using two animals. In one of these I injected pure alcohol, exposing the iliac artery, and inserting into this a hypodermic needle, and, when within the lumen of the vessel, the syringe was emptied, closing the artery behind the needle by compression so that the fluid could only be forced in the direction of the capillaries. Into another large artery I injected paraffin, which was coagulable at 108° F. This was injected in liquid form, being taken out of a warm tube and employed in a syringe already warmed.

In both iliacs of another animal I used boiling water, taking a metal syringe (especially adapted for this purpose) out of a small caldron, filling the cylinder with boiling water, and immediately injecting this into the vessel. The dogs were killed ten days after these injections, and studied, with the following results:—

The artery in which the pure alcohol had been injected was still pervious, and there did not seem to be any marked change in the tissues of that extremity. The vessel which was injected with paraffin was occluded down to vessels of about one-twentieth of an inch in diameter, but this substance did not seem to flow into the smaller vessels, and while the muscular tissue was pale, and had evidently undergone some degeneration due to anæmia, there was no gangrene in this extremity. In both the arteries in which the boiling water was injected there was complete arrest of the circulation, and gangrene of the legs ensued.

I have, as yet, not had an opportunity to use either of these agents in the effort to shut off partially or completely the vascular supply to inoperable tumors.

Objection may be raised that vessels not contributing to the blood-supply of these neoplasms will also be involved in the process of obliteration, as, for instance, the temporals[1] and the inferior dental. It may also be objected that the meningeal branches would be obliterated and a certain amount of meningeal irritation or inflammation induced. An inflammatory process thus established would, in all probability, be mild, since no septic organisms could be present. These objections would probably not hold good in the employment of paraffin, since this substance could scarcely be thrown into the smaller vessels, including only the larger trunks leading in the direction of the tumor.[2]

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[1] The essayist would suggest that it will be easy to prevent injection into the superficial temporal (except at its beginning) by the finger where it passes across the zygoma.

[2] The essayist would note here that the reason why Dr. Wyeth's paraffin injection did not penetrate arterioles "smaller than one-twentieth of an inch in diameter" was that it was not injected warm enough. By experiments upon dogs I have found that even the smallest branches may be entered if the original heat be about 120° F. (49° C.). This is entirely safe; it can do no damage even if it did not with such speed cool down to the solidifying-point. Kirke's "Physiology," eleventh edition, page 846, states that globulin coagulates only at 70° C. (158° F.); and Dalton's "Physiology," seventh edition, page 80, affirms that serum-albumin clots only at 72° C. (162° F.).

These few experiments are too limited to be of scientific value, and it is my intention to go further in this direction during the coming winter.

In July of this year (1901) I treated a large angioma of the face (cavernous nævus) in a young woman about 25 years of age. It extended over the lower half of the right buccal wall and cheek, and along the lower lip, completely covering the chin as far as the commissure of the mouth on the left side, and extended over the chin and down to the neck, protruding three or four inches below the ordinary level of the chin. The overlying integument was not discolored, but within the lip on the mucous surface large blue sinuses could be distinctly seen, and these crowded themselves up to the level of the teeth on the right side of the mouth. The whole mass was elastic on compression, but pulsation could not be felt.

Two years prior to this date I had attempted to remove this neoplasm by operation, but after a careful exploratory puncture such profuse hæmorrhage occurred that I abandoned the attempt. After witnessing the results of the injections of boiling water into the vessels of the dog I determined to try this method in this case, and had the patient come to the city for treatment. Under ether narcosis, by employing a metal syringe holding several drachms, boiling water was injected into the upper portion of this mass, about two square inches being thus treated. A large-sized ordinary hypodermic needle was screwed on to the cylinder of the metal syringe, the solid metal piston of which was removed and placed also in the caldron. The cylinder was rapidly filled with boiling water, the piston placed in position, the needle pushed through the skin and well into the vascular growth. About one drachm of boiling water was forced out, the needle withdrawn for one-half inch, and this quantity again injected. In this first operation three syringefuls (3 drachms) were employed. Care was taken to exercise compression around the margins of the injected area for fear that a clot might be dislodged into some efferent

vein. No noticeable reaction followed this experiment. The skin was not burnt nor even turned red by the treatment, and there was very little pain following the recovery of the patient from the narcosis.

Within forty-eight hours there was noticeable solidification in the part which had been injected, and it immediately began to shrink. Two weeks after the first operation I was so encouraged that I again etherized the patient and subjected the whole mass to the same method of treatment. While the hot water was being thrown in I had my assistant insert his finger between the gum and the lip in order to inform me when the needle approached the mucous surface, in order to prevent throwing the hot water into the buccal cavity; and, although his finger was fully one-fourth of an inch distant from the point of the needle when the injection was begun, such was the heat from the liquid thrown into the tissues that he was compelled to remove his finger. The same satisfactory result followed the more extensive operation. No reaction occurred, pain was very slight and did not require an anodyne, the skin was not burned, no sloughing occurred at any point, and atrophy of all the injected area supervened. The patient returned to her home in Virginia, and writes me that the growth has diminished in size steadily since the last operation, and at this period is practically cured.

It would seem that the use of boiling water may have a still further application to surgery. It has already been used successfully in the treatment of incomplete external fistulæ of the perirectal region. It would, in all probability, do more to render aseptic an abscess-cavity than any other agent we could employ. I should not hesitate to use it in the treatment of all forms of angioma when the location of the tumor would permit any form of escharotic. By careful employment it may secure atrophy without sloughing, and if this could be accomplished it would be an ideal treatment for these neoplasms.

CHAPTER IX.

Histories, with Commentaries, of Cases Treated by Injection, Supplementing Excision of the Superficial Carotids.

In fairness to the operation of carotid extirpation, the following cases, with two exceptions, are not tabulated under that head, although such extirpation was performed also:—

Case I.

Cystic Sarcoma of Left Side of Face and Neck.

(Case of Dr. J. Julio Henna.)

Admitted early in May, 1901, at the French Hospital, New York City, Dr. Haskell, house surgeon. Patient, Mr. Felicien N., *æt.* 40; native of Porto Rico. Merchant; married. Family history without bearing upon malignancy; never has had venereal disease. All organs normal in function.

The patient, a well-built man not particularly cachectic in appearance, states that for the past four months he has had pain, and for the past two months has noticed a rapidly growing tumor in the same region, namely: the left side of his neck near the lower jaw. This swelling was incised by a surgeon in Porto Rico, who evacuated merely blood, and advised his coming to New York for treatment by Dr. Henna. Upon arrival here he presented so large a growth as to flex laterally his head toward the opposite side, though this varied considerably in degree from day to day. There was from tension some threat of sloughing involving the skin over it. At its worst it extended over an area, roughly speaking, involving the side of the face and neck from nearly the lobule of the ear down to the level of the lower end of the larynx, and extending in front to within 2 $^1/_2$ centimeters of the median line, and at the back to within 8 centimeters of the median line.

Dr. C. H. Peck, surgeon to the hospital, being asked to operate, did so by exploratory incision during the early part of May, incising and emptying a large cyst filled with bloody fluid, but no pus. This reduced the bulk of the tumor about one-third. The solid portion was nodular and firm. Dr. Peck, deeming thorough ablation impracticable, and that the attempt would inevitably end fatally, declined to proceed. A small piece was removed for pathological examination. Report: round-celled sarcoma.[1]

The patient was informed next day that nothing could be done for him, and in an utterly hopeless state of mind he arranged to go home to die. At about this juncture the visiting staff of this hospital learned of the work the essayist was then conducting upon dogs, by the injection plan; also of his previous operations by anæmia upon human beings; and Drs. Henna and Peck, of that staff, very courteously invited the essayist to give this patient his chance, if chance still existed. The facts as to its nature were fully explained to the latter, who consented to the attempt.

In the presence of Drs. Henna and Peck, and five other physicians, and by aid of the house staff, upon May 30, 1901, the operation was performed, under ether anæsthesia.

The case seemed perhaps a fitting one upon which to try Wyeth's suggestion of plastic injection of the artery, because the upper part of the external-carotid region was so solidly involved in malignancy that excision there seemed impossible of accomplishment. Even to expose enough of the lower part of this vessel to ligate it and use the distal end for injection would not be easy; but it was hoped that only adherent lymph-nodes, and not the tumor proper, would be found in the way so low as this (the carotid bifurcation).

Instead, a mass of sarcoma plus dense adhesions compelled tedious dissection. Of this one may judge by the fact that, whereas ordinarily the operator expects to expose and place his ligature about the superficial carotid in about three minutes, this step alone required the astonishing period of more than an hour's work! Then it became plain that the

[1] Dr. Henna, who has many friends in Porto Rico, informs the essayist that sarcoma, and especially of this region of the body, is exceptionally prevalent there. This is mentioned as an item of general surgical interest.

vessels themselves had undergone malignant softening. During gentle tying the superficial carotid was cut through by the catgut, necessitating instant clamping; and in fastening in place a small, glass cannula, with a rubber tube connected, for the injection, the ligature again cut through the vessel's wall. Presently the latter, under a slight accidental pull by an assistant, broke across high in the wound and was lost. At length we struck upon the expedient of starting at a low point on the facial (of course, easily felt pulsating) and dissecting this back toward its origin. This, after about three centimeters, led us to the superficial carotid, and close to the facial it was once more tied over the glass cannula. The superior thyroid had as early as possible been ligated and divided, also the lingual.

Neither larynx nor tongue being involved in the sarcomatous disease, we deemed it best not to include them in the parts filled with liquid paraffin. This upon hardening must necessarily render motion difficult and stiff in any part filled with it, and we feared thus to cause trouble with phonation, articulation, or even possibly with deglutition. This being a wholly new procedure, caution demanded limitation of the method to the malignant region and its feeding vessels solely, if possible.

Next the injection was proceeded with as promptly as was possible. (To avoid repetition, this will not be discussed further than to say that it was the same mixture of paraffin used at the same temperature as described and recommended upon page 147 of this essay.)

Quite unfortunately, once more a vessel broke—this time during the distension. It was the facial, not far from its origin. It had not been ligated, as it was deemed essential, from the situation of the growth, that it should be included among those to be paraffin-plugged. At once it was clamped; but this accident prevented accurate estimation of the amount of the mixture injected into and held by the superficial carotid system.

As the neck wound was about to be closed, mechanical trouble with the breathing developed—or what was thought to be, upon the spur of the moment; and, traction upon the tongue, swabbing out the entrance to the larynx, etc., giving no relief, a rapid laryngotomy was performed. Following this the

breathing was distinctly better, but yet not good; neither was the pulse, which was 140. Two liters of intravenous saline infusion were now introduced into the right median basilic vein, at a temperature of 120° F. And other vigorous stimulants employed; but the patient finally succumbed. *Exitus lethalis* at 2 A.M., May 31st, about ten hours later, of shock. It was noted that the *respiration was worse than the circulation;* and that the latter continued for a brief period after the former had quite ceased.[1]

The patient never regained consciousness after the operation. For some hours prior to death it was observed that the left pupil (that upon the operated and injected side) was larger than the right one. Autopsy not permitted; but section of the temporal artery opposite the zygoma by Dr. Haskell showed it filled with the white, solid paraffin mixture.

It is conceivable that too much paraffin injected may have accounted for the difference in the pupils; the anastomosis between infra-orbital and ophthalmic being remembered, and the remarks on page 134. As to the cause of death any surgeon closely reading the history of this operation will, it is believed, agree that in a patient so advanced in cachexia an operation which proved of such enormous difficulty would be likely to induce death from failure of heart or respiration, either or both, and without attributing death in any measure to the injection plan.

CASE II.

Carcinoma of Tongue and Submaxillary Salivary Gland.

(Case of Dr. H. G. Howe.)

Admitted to Hartford General Hospital, Hartford, Conn., June 16, 1901; Dr. G. S. Towne, house surgeon. Patient, James X., Irish; *æt.* 74; tailor. Family history negative. (He claims that one grandfather died at the age of one hundred and twenty-five years!) Has been a heavy smoker all his life, and intemperate as to alcohol. His vessels are very atheromatous to the touch. Denies venereal.

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[1] See comment by essayist upon Case VI of this series.

Present trouble first noticed about a year ago, in the form of small blisters beneath the tongue, which would appear and heal, again and again. Six months ago he began to be annoyed by noises in his ears. It was for this that he came to our outdoor clinic. About this time he observed a small lump under his tongue upon his right, and began to complain of pains in the lower part of his face on that side. His tongue, on examination, is perhaps a third larger than it should be, and the tumor involves it beyond its middle and includes the floor of the mouth. The submaxillary gland and adjacent lymph-nodes are seriously involved.

Operation, June 17th, by the essayist, who had been invited by the entire surgical staff of the hospital for this purpose. Because of the advanced age and marked atheroma, the probability of his tolerating any surgical measure was very problematical. However, excision of his right external carotid was performed without unusual feature, occupying twenty-five minutes.

Injection of the upper end of this artery followed, using a mixture of white vaselin, 9 parts, and pure white hard paraffin, 1 part, melted together and filtered through gauze. The amount employed was 12 cubic centimeters, of which perhaps 4 cubic centimeters were lost because of its escape through a few small vessels not noticed and tied. This amount was, we fear, too large, though not more than used, with recovery, by the author and others in some instances among these histories.[1] The patient's condition during the last part of the work upon the carotid had become bad, necessitating haste; but it was immediately after the liquid paraffin injection that his respiration suddenly ceased, his heart causing comparatively little anxiety. Artificial respiration and oxygen were instantly brought into use. Two liters of hot, saline infusion, intravenous, were introduced while on the table. In spite of every measure of recuperation, this patient succumbed to the respiratory failure one and a half hours after the operation.

An autopsy was refused. A small portion of the superficial temporal artery, under the scalp, was, however, dissected out, and proved solidly filled with the paraffin mixture.

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[1] See page 170; also note by essayist, page 173.

CASE III.

Recurrent Carcinoma of Left Side of Face and of Lower Jaw.

(Case of Dr. G. Pierrepont Davis.)

Admitted July 26, 1901, to Hartford Hospital, Conn. Patient, R. L., *æt.* 66; American; male. Family history negative. Denies venereal. Has always been temperate. Had acute articular rheumatism forty years ago, with frequent recurrences since that time. (May have a bearing upon cardiac strength.) Palpitation of heart and vertigo, with occasional attacks of syncope, many times since 1860.

Two years ago the patient developed a superficial ulcer upon the lower lip, on his right side, ascribed by him to irritation from a decayed tooth. This ulcer in the course of six weeks spread from the border of the mucous membrane downward toward the chin for about one and a half inches; breadth, one-half inch. This ulcer was removed by amputation of the lower lip in Hartford Hospital after it had been present six weeks, by the attending surgeon, Dr. Davis, and found to be epithelioma. There has been no recurrence at old site.

Present illness: About six months ago patient noticed a small ridge about the size of the little finger obliquely across the lower border of the ramus of the mandible upon his left, about two inches anterior to its angle. The swelling was rather hard, but caused no pain or discomfort. Patient says that it soon nearly disappeared, only to reappear again and again. Three weeks before admission the swelling became persistent and larger; and he suffered sharp, lancinating pain in the jaw. The bone became much softer in consistence, as well as smaller in the same region. Some complaint of insomnia of late from pain.

Examination: Patient is tall and rather stout. Superficial vessels—veins and capillaries—chronically dilated. The heart is recorded as having the muscular element of the first sound weak. The urine normal except for the surprising specific gravity of 1.001. Upon the left cheek just above and in front of the lower border of the jaw is a tumor the size of an English walnut. It is highly vascular, giving a semifluctuant feel upon palpitation. July 27th Dr. Davis operated for the relief of a collection of pus within the walls of the growth on the cheek.

A piece of this then removed and examined by the hospital pathologist proved epitheliomatous. From this time onward the cancer grew rapidly. Before the essayist saw him in the latter part of August the swelling had extended "nearly to the zygomatic arch above, and downward to distinctly below the lower jaw." The mouth and gums had become exceedingly sore and the lower jaw continually enlarged upon his left. August 28th the essayist operated upon this patient, going for the purpose to Hartford at the request of the surgical visiting staff, several of whom were present, Dr. Davis kindly acting as chief assistant. The patient seemed then not excessively weak. The urine had increased in specific gravity and was then 1.009. Ether anæsthesia was used. The left external carotid was excised, without incident of importance, the operation, which took about a half-hour, being somewhat delayed by the necessary removal of several large and adherent lymph-nodes.

It being the intention to use for this patient Dr. Wyeth's suggestion of obstructing the vessel by injection,—the more particularly since, by reaching in this way the inferior dental artery, his diseased lower jaw might perhaps be controlled,—we now prepared by tying into the distal stump of the external carotid a glass cannula, with short rubber tubing attached; and through this was injected about 8 cubic centimeters of the warm paraffin mixture described heretofore.

Almost at once the respiration grew irregular in rhythm and presently ceased, the house surgeon beginning the use of Sylvester's plan of artificial respiration without delay, supplemented by free use of oxygen, and various respiratory and cardiac stimulants by the promptest route. The heart was far from satisfactory, but it was the respiration which suddenly caused the chief anxiety. The wound was hurriedly closed, and every effort continued in his behalf, but without avail. He died twelve hours later, from respiratory failure. No autopsy was permitted by the relatives, though urgently asked for. Dr. Davis remarks, in a recent letter to the essayist: "It is practically impossible in this State to get consent to hold autopsies."

This case was a great disappointment to the essayist; and, if he may judge from his previous instances of excision of the carotid and from this patient's condition at its end, had nothing further than that been attempted, the patient might

well have recovered. This is a bitter thought; and yet the writer acted conscientiously, and only adopted the plan after a most careful line of study and preparation. It seemed to us a case which, to a more distinct degree than others of this brief and unhappy series of cases treated by injection, pointed toward the injection fluid as responsible for the death. And yet one cannot speak with certainty. That the committee may have the same basis as the essayist for reaching a conclusion all facts that bear upon this subject must be stated. It will be remembered that, only after cadaveric experiments which seemed to show that the amount injected was quite safe, was it used at all. However, from a single cadaveric instance mentioned earlier in this essay, we must now infer that at times the smaller amount now advised is alone to be considered safe.[1]

Case IV.

Carcinoma of Palate and Both Tonsillar Regions.

William Bruce; Scotland; machinist; *æt.* 54. Sent to essayist by Dr. William Titus, of Newark, N. J. Denies venereal. Has been a heavy pipe-smoker for most of his life. Drinks moderately. Tumor first noticed eighteen months ago, when it was to the exact middle of the soft palate. It now involves the entire rear half of the mouth, including the entire pharyngeal region so far as visible. Notwithstanding the great extent of it, his color is good. He is, however, very weak, having lost thirty pounds in the past four months. Within two months past cannot swallow solid food, and now even liquids with difficulty, from sheer mechanical obstruction to their passage.

Report of Professor Jeffries, upon a piece snipped from the growth: "epithelioma of exquisitely typical kind."

Patient states that Dr. Torek, of New York, operated upon him some months before he came to me, but left most of the growth. (It would have been impossible to do otherwise.)

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[1] Observe footnote to Case II in this chapter.

Patient was admitted to the Polyclinic Hospital, November 10, 1901. First operation, that upon his right side, external carotid, November 12th. Present: Drs. Bristow, Titus, and the resident hospital staff. Operation complicated by a very high bifurcation, and by large, adherent lymph-nodes. Together with the injection, it took one hour. As to the latter, 8 cubic centimeters (℥ij) of yellow vaselin, sterilized by heat and cooled to 120° F., were used, the vessel of paraffin mixture having been broken at the last, too late to prepare again. There was no sense of resistance whatever; a larger amount could readily have entered, but would have been dangerous; indeed, this was too much. (See page 134.) It entered the end of the superficial carotid, close to the parotid gland. The occipital was not plugged in this case. Not having before used plain vaselin, I preferred to see the outcome without additional injection at this session.

After the injection the external carotid was excised without ligation at its distal end. His pulse at the end was 72; his respiration, 18, and wholly normal also. He had an uneventful recovery, except that there was an alarming partial paralysis, observable next day, of the orbicularis palpebrarum. He could not fully close his eye on that side. It also was much congested, and the sight was so much diminished that he could only read the "scare" headlines of newspapers.

Ophthalmoscopic examination showed considerable venous congestion of the retinal vessels. Within a week all these signs had practically disappeared, except the control of the orbicularis, which remained somewhat defective so long as he was under observation.

It seems plain that in this case we came perilously close to the disaster of blindness due to plugging the arteria centralis retinæ. Some of the outlying branches of the ophthalmic must, it would seem, have been obstructed, as it was, in order to explain these ocular phenomena.

At that period the essayist had not, in his cadaveric experiments, met the instance referred to at the end of Chapter V, where 45 minims sufficed to overfill the external carotid termination and its two subdivisions.

There was quite a striking degree of pallor and of shrinkage of the cancer following this first operation.

Upon November 22d the left superficial carotid was attacked, just as upon the right side. In this instance the usual paraffin mixture was used, at 120° F., and 6 cubic centimeters (3iss) were injected into the end of this vessel and including, besides its bifurcation, a rather large anomalous branch high up and toward the rear, which last perhaps communicated so freely with his posterior auricular as to explain the resulting gangrene thereabouts (the occipital, as before, was not injected), for nearly three-fourths of his left ear underwent dry gangrene, and a patch of skin about six inches square behind and below this ear sloughed; also just the edge, at several points, of his right ear, and a few small spots—perhaps an inch in aggregate, and very superficial—of one of his cheeks. This was very distressing to the operator, and a wholly new experience. It indicated the need, if this new plan of injection is to be continued, of using distinctly smaller dosage. (This is discussed on pages 134 and 135.)

This patient's cancer sloughed extensively, but not wholly. Considering its great extent, probably he had as large an amount of dead tissues to come away, and meantime to poison him more or less, as he could tolerate. By scissors and forceps, as they separated, the sloughs were removed. The odor was very offensive in spite of very free use of antiseptic mouth-washes, by fountain-syringe. When he finally was discharged from the hospital in December his condition cannot be said to have been locally much bettered, and his strength was even less than when he entered. He died May 21, 1902, as his wife informs me.

Considering his condition upon admission (even fluid swallowed with difficulty; thirty pounds lost in four months), I am forced to believe that his life was extended by a few months, through the medium of these operative measures. I do not know, however, and rather doubt whether the injection helped in this respect; and certainly it added distinctly to his suffering. Perhaps a much smaller amount—say, 2 cubic centimeters—would as well have retarded growth, and might have avoided sloughing.

The two following cases (four operations) were reported to me by Prof. A. T. Bristow, of Brooklyn, in both of which the injection plan was used:—

Case V.

Adenocarcinoma of the Right Side of the Face.

(Case of Dr. A. T. Bristow, of Brooklyn.)

"Patrick Kenna, laborer; *æt.* 55; until two months previous to admission to the Long Island College Hospital was always in good health. Then commenced to have severe pain in the right side of face. Soon noticed a swelling below the malar bone, and began to have difficulty in breathing through right nostril. On admission the face on the affected side is much swollen. Inspection of the right nasal cavity discloses a growth pushing over to the septum, entirely occluding the passage. On examining the cavity of the mouth the hard palate on the right side is seen to be pushed downward. The vision in eye is confined to light-perception. There is a sinus just below the right eye. A probe pushed downward goes into the antrum. By means of a curette a part of the mass filling the antrum is removed for the pathologist, who after examination pronounces the neoplasm to be an adenocarcinoma. Removal of the superior maxilla does not promise any hope of permanent cure, and the operation devised by Dr. Dawbarn, extirpation of the external carotids for the purpose of starving the growth, is accepted by the patient.

"November 26, 1901, operation as described by Dr. Dawbarn done on patient's left side and found to be relatively easy, being completed in sixty-five minutes. The patient had a long, thin neck, and the bifurcation was low down. The superior thyroid was given off from the common carotid just at the bulb. It was, however, tied. When the external carotid had been dissected above the posterior auricular, a cannula was introduced into the stump and 2 ½ drachms[1] of vaselin injected for the purpose of shutting off the internal maxillary branches and temporal artery. After

[1] Note the amount injected, safely, in this case.

operation the temperature reached 100 but once, and patient made a rapid convalescence. On December 18th the external carotid of the other side was extirpated, but owing to a higher bifurcation, the operation was more difficult, yet was completed in fifty minutes. This side received no injection, as it was resolved to take no risks with the anastomosis between the infra-orbital of the internal maxillary and the ophthalmic branches, lest the arteria centralis retinæ might receive a charge of vaselin and instant blindness result. The pallor of the face was noticeable after both operations. After the second the swelling of the face diminished very rapidly, and at the time that patient left the hospital it was but one-third of its former dimensions and the discharge from the sinus had ceased." This patient was still alive in November, 1902, though quite weak. It is plain that in this case the operation has prolonged life.

Case VI.

Sarcoma of the Antrum.

(Case of Dr. A. T. Bristow, of Brooklyn.)

"Case IX operated at the Kings County Hospital. This patient was an Italian, *æt.* 53, of very large frame, with thick, bull neck. This patient was at first in the special surgical division, owing to some difficulty with the molar teeth on the left side. At least, when admitted he referred all his trouble to decayed teeth, which were extracted and the antrum trephined. The pain continued, however, and he began to have the same difficulty in breathing through the nostril of the affected side complained of by the last patient. Was now seen by Dr. Jonathan Wright, who made a diagnosis of sarcoma of the antrum, and referred him to the general surgical division for treatment.

"On December 19, 1901, extirpation of the external carotid on the left side was done [by Dr. Bristow], but under great difficulties. The patient took ether very badly, and the anæsthetic was changed to chloroform. A mass of glands was removed from the internal jugular. It was then found that the vein

overlapped, or rather overlaid, the artery for a considerable distance and it was necessary to dissect it away and pull it to one side. The tissues in the region of the external carotid were matted together; so that the dissection was tedious, the division was very high, and the vessel deeply placed. Owing to the matting together of the tissues, the hypoglossal nerve was not at first recognized, and a clamp was placed on a band of tissue, which was subsequently found to contain the nerve. The clamp was immediately removed. The operation was one of the greatest difficulty, and the patient took the chloroform badly. However, the external carotid was finally freed beyond the posterior auricular and the stump injected, as in the previous case. The patient made a good recovery.

"On January 30th the second operation was attempted, but only partially completed. The patient took his anæsthetic even worse than before, and the bifurcation was even higher than on the left side. Indeed, it has been my experience that the right common carotid, as a rule, bifurcates much higher than that on the left side. It has proved to be the case in all my three cases.[1] The same trouble with tissues matted together was experienced as on the other side, and some infected glands required removal. All the veins were of enormous size, and the external carotid was very deeply placed. The lingual, facial, and ascending pharyngeal all came off in a bunch and were separately tied and divided. The patient now stopped breathing, and was restored with much difficulty. However, I then went on and endeavored to complete the operation. I failed to recognize the hypoglossal nerve on this side also, and maltreated it, before I discovered its identity. Owing to the bad condition of the patient and the very great depth of the remaining part of the vessel, I reluctantly abandoned the completion of the operation and did not inject the remainder of the carotid with vaselin. The patient when bandaged appeared to be in fair condition. He had lost but little blood for a man of his size,—perhaps, four ounces,—and the greater part of this was due to the fact that I unwittingly tore a large vein in the upper and deepest angle of the wound, which was secured with difficulty.

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[1] The essayist has not personally observed this difference upon the two sides.

"About twenty minutes after his return to the ward the nurse reported that patient was blue and breathing badly. He died before the house surgeon could reach him. I am puzzled to account for his death, unless it was due to the dropping back of the tongue in a partially conscious patient from a paralysis due to the injury to the hypoglossal, for it is to be remembered that at the first operation the left nerve was injured, as was shown by some hemiatrophy of the tongue following. Although six weeks elapsed, it seems to me to be likely that the injury to the right nerve, too, may have been sufficient to produce a double paralysis which caused the tongue to drop back and suffocate the man.

"While he was in charge of the anæsthetist, of course, if the patient had breathed with difficulty, his tongue and jaw would be immediately brought forward and disaster averted, but no doctor was present at the time he was found suffocating. It would seem that in fairness this death should not be credited against the operation of carotid excision, as but for the hypoglossal-nerve accident it would surely not have occurred. Microscopical examination of glands removed showed a sarcoma."

NOTE BY ESSAYIST: This case is additionally interesting because of the blueness and respiratory failure, although no injection had been used to plug the vessels at this final operation. If the operator *had* plugged them, it is possible that these symptoms and the death would have been attributed to the injection plan by those readers who have closely followed the histories of the few operations as yet done with the aid of this device.

CASE VII.

Carcinoma of Tonsil and Adjacent Parts.

Mr. Thomas Clifton; *æt.* 50; American. Denies venereal. Sent by Dr. John T. Howell, of Newburgh, N. Y., admitted to the Polyclinic Hospital, December 23, 1901.

This patient had suffered for about five months with a new growth originating from his left tonsil, but now involving so

huge an area that I estimated that not far from nine square inches of surface would have to be excised in order to surround it; and as he was very weak, with a pulse upon admission of 120, we feared for the immediate outcome of such an extensive operation. His jaws were almost locked, and had been so for several weeks, permitting him only liquid food.

During the operation upon his left side a mass of diseased lymph-nodes receiving the tonsillar drainage was excised, and Professor Jeffries pronounced these to be carcinomatous.

The first operation was a simple excision of the superficial carotid upon his sound (right) side, which was performed by the essayist, assisted by the house staff of the hospital, without noteworthy incident, upon December 24, 1901. Primary union followed.

One week later, December 31st, the patient being in rather better condition, the second excision of the carotid was proceeded with. In this the paraffin mixture, at 125° F., was employed.

We took the following steps to avoid plugging more of the face and of the tongue than desirable, and nevertheless to try to shut off almost wholly the tonsillar supply upon the diseased side.

The convexity of the incision was placed even farther forward toward the median line of the neck than usual (see Chapter V), ending it by a final stroke running rather sharply backward at its upper end. This enabled me to expose not only the superficial carotid as usual, but after throwing a ligature about it (but not yet tying) to expose with ease the facial artery high up, where it is crossing the body of the lower jaw. Here it was ligated, as also the lingual in Lesser's triangle. By this means we made sure that the paraffin injection would not readily reach the vessels of the face, nor those of the front part of the tongue. But the ascending palatine, tonsillar, submaxillary, and submental would be plugged, upon injecting the beginning of the facial; and the dorsalis linguæ (supplying the tonsil also) upon injecting the beginning of the lingual.

Since the submaxillary and submental regions are so subject to glandular involvement from cancer of the tongue and adjacent parts, we were glad to obstruct the region beneath the chin.

When, now, the termination of the superficial carotid, with its bifurcation, should be injected too, the *descending* arterial supply of the tonsil would be obstructed, namely: the small meningeal and descending palatine, both arising from the internal maxillary.

Thus, all six arteries of the tonsil except the ascending pharyngeal—commonly a rather insignificant branch—would be obstructed. (The tonsillar arteries may, for convenience of description, be said to be as follows: 2 ascending [the ascending palatine and ascending pharyngeal]; 2 descending [the descending palatine and small meningeal]; 2 running transversely [the tonsillar and dorsalis linguæ].)

Continuing the operation, the ascending pharyngeal proved very small, and was tied off at its origin; the occipital and posterior auricular were treated similarly; and finally the superficial carotid itself, low down. Next, a nick was made transversely into this vessel one centimeter above the ligature, but still below its lingual branch; and now everything not ligated (as above described) was plugged with the injection fluid at 125° F. There was one exception, however. As nothing of importance could apparently be gained by plugging the superficial temporal, and risking a possible sloughing of the skin of the forehead, the finger upon the zygoma controlled this artery at that point.

The amount used was 3iss of the usual paraffin mixture.

Next, the superficial carotid was excised up to the parotid gland. It was not ligated above, and neither were the plugged occipital, lingual, nor facial branches, where cut across. The obstruction made that procedure needless.

The patient did well. The other side of the tongue and the front half of it upon the diseased side not being paraffin-injected, it was not too rigid to control the epiglottis, though much care in swallowing had to be exercised to avoid coughing immediately after deglutition. Unfortunately there was a little skin-sloughing, but not much: just the edge of the convexity of the ear, at a few points, and at the angle of the jaw. These healed finally, with hardly noticeable scarring.

As might have been anticipated, the whole cancerous region sloughed, *en masse*, though this did not extend to the surface save at a trifling point or two. We feared a little for the deep carotid and deep jugular, but no secondary hæmorrhage

occurred. Piece by piece the sphacelus was clipped away, as it loosened, this being very difficult because of the continued semilocking of the jaws. Abundant mouth-douching by fountain-syringe was used, mainly with permanganate-of-potassium solution; nevertheless the odor was very disgusting until all the necrotic parts had been cast off. A healthy and rapidly healing cavity was left where the cancerous tonsil and palate had been.

But some three weeks after the second operation he was increasingly troubled by a cough which he had had even upon admission. His sputum proved tubercular, and, as he was rather retrograding than gaining in strength and had developed a slight, but regular, afternoon rise of temperature, he was dismissed to his home in the country.

Dr. Howell reported to the essayist during the following summer that this patient died of tuberculosis in May, 1901. As to the cancer, considering its very extensive character, and the patient's feeble vitality, the outcome was gratifying. Dr. Howell said that there was no evidence of return except one very small nodule above the tonsillar region, in the palate upon that side. This only appeared in the month before he died.

The experience gained in this case, as also that of Mr. Bruce, convinced the essayist that smaller amounts of injection fluid would be wise, to save the skin from danger if for no stronger reason. (See "Technique of Injection," Chapter V.)

Case VIII.

Epithelioma of the Left Cheek.

Carl A. Field, *æt.* 51; male; American; hostler. Denies venereal. His mother's brother died of cancer of face. Is sent by Dr. W. H. Ross, of Brentwood, N. J.

For fifteen years he has had an ulcer upon the outside of his left cheek near its middle. Within the past year this has extended and deepened, and now involves, including surrounding induration, practically all of this side of the face below the eye. For three months past his jaws have been firmly locked, compelling the use of liquid food alone. Because of this and

distinct cachexia he is quite weak. A piece of growth excised and examined by Dr. Jeffries was pronounced epithelioma.

He was admitted to the Polyclinic Hospital February 21, 1901; operation upon his left side next day. Complete excision of the superficial carotid plus injection of paraffin mixture at 120° F. into distal end of this vessel close to parotid gland (40 minims) and about as much into the occipital artery. The temporal was not controlled at the zygoma. Primary healing. No unpleasant symptoms whatever.

His second operation was performed March 1st, at the same hospital. This proved to be very simple. Being upon the sound side, no diseased lymph-nodes were in the way. A shade less than two and a half minutes required to find and pass a ligature about the superficial carotid. Professor Goffe present. After the five other branches were tied and divided, the occipital and terminal two were plugged with paraffin just as before. A drachm of this entered the latter vessels and end of this carotid, and 40 minims were thrown into the occipital. There was no change in pupil, nor alteration in the pulse or respiration thereafter. Patient put to bed in excellent condition: pulse then 90; respiration, 18.

One hour later I examined him; he was then awakened from anæsthesia. Condition satisfactory. To my great surprise, word was telephoned to my office, within two hours after this, of his sudden death from hæmorrhage. About one hour after the time of my visit the orderly noticed blood streaming from below the dressings. He cut these and saw it welling up from the wound. Pressed on this, checking flow, and sent message to Professors Townsend and Bodine, who chanced to be then in the hospital. They opened the wound, finding it tensely full of clots, but not then bleeding any longer because the patient had promptly fainted. In spite of every effort he did not revive. They noted that the ligature was in place upon the stump of the external carotid; and, of course, as the occipital and the termination of the external carotid in the internal maxillary and superficial temporal were noted as being all paraffin-plugged, evidently these vessels could not have been the source of bleeding. They had also been tied.

I made a most careful post-mortem examination of the wound, assisted by Dr. Munday, resident interne. The ligatures were found upon the stump of the external carotid, the supe-

rior thyroid, lingual, facial, occipital, and posterior auricular; also the external carotid where it passes into the parotid gland.

The ascending pharyngeal had been twisted, being but insignificant in size. This completes the list of branches.

In one sense, it was a relief to me to know that no carelessness of technique had allowed an artery once tied to slip its ligature and start a hæmorrhage; but the source of bleeding remained unexplained. The deep jugular and every other chief vein proved intact. Still, the man had bled! I was forced to the conclusion that some large, thin-walled vein must have been torn across during the operation, and had not bled much, not enough to be observed there and then; perhaps a retractor pressed its mouth close, so that a clot formed. And when later on the patient strained, due to nausea, the clot was expelled from the torn vessel and bleeding began into the wound. In further support of this, the only possible explanation as it would seem, the orderly reported that the bleeding was noted shortly after vomiting.

The entire loss of blood was not at all great; but the patient was strikingly cachectic and pallid from his long-standing cancer, and for months had been obliged, from locking of his jaws, to subsist wholly upon liquid food. Presumably these factors weakened his heart; so that it could not support a fainting spell otherwise not a dangerous one.

This sad case is evidently not instructive as to the special technique of this operation. From the same reasons any very weak and cachectic patient might have died, and, I think it will be admitted, without fault of the technique nor carelessness properly to be imputed to the operator—after almost any cutting operation in a region richly supplied with veins.

Case IX.

Cancer of Lower Lip and Jaw.

(Case of Dr. Bristow.)

Philip Coyle, *æt.* 62, Irish, single, laborer. Family history negative; ditto previous personal history. Present condition began in January, 1902, when he noticed a fissure at the

angle of the mouth, upon his right, where he had been in the habit of holding his pipe-stem. By six months later a deep ulcer had formed at this point, extending to and involving the subjacent mandible; so as to be ineradicable. Examination of growth, by the pathologist, Dr. Van Cott, shows it to be epithelioma. Has been treated, ineffectively, by the x-rays.

Admitted to Kings County Hospital, and first carotid operation performed upon his left side, February 19, 1903. The usual extirpation was followed by injection of the paraffin mixture heretofore described, into the end of the superficial carotid close to the parotid gland. The amount was one and one-half drachms. No ill results. Was returned to bed in a normal condition.

Upon March 5th the right superficial carotid was excised. Dr. F. H. Wiggin and the essayist present by invitation. Operation somewhat more difficult from a higher bifurcation. At both operations it was noted that the patient's breathing became irregular, and he required resuscitation from this cause at the stage of the operation where the carotid end is being made to "dive" beneath the twelfth nerve. I have noted this before, and the cause is an interesting question. Upon termination of the customary excision the paraffin mixture to the amount of 30 minims was thrown into the end of the carotid stump, at the parotid level.[1]

In a letter received at the end of March, this same year, Dr. Bristow remarks that both this case and Case XIII have done exceedingly well since operation, "and the tumors have shrunk in a manner that is remarkable."

Case X.

Epithelioma of Mouth and Lower Jaw.

H. E. M., American, *æt.* 45. For nearly two years has suffered from cancer of the palate, tonsils, and the lower jaw, upon

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[1] Note that in this patient's right carotid-end ℥iss was injected, without ill result; also, that in none of Dr. Bristow's cases has he thought it best to inject the occipital also.

his left, laterally. The pharynx, as far down as can be seen, is also involved. Only as a last resort, and some six weeks after being advised by his physician, Dr. Lewis A. Coffin, of New York, to put himself in the writer's hands, did he agree to do so. Then he was extremely weak, and had long been able to take only liquid food. But for the unremitting devotion of his sister he would doubtless have been dead months before.

Though this case seemed almost a hopeless one, and because of the very extensive involvement I declined to promise even any amelioration, yet I did not feel at liberty to refuse him his only chance.

Admitted to the Polyclinic Hospital, March 24, 1902. A piece excised and examined by Professor Jeffries proved to be cancer of a typically epitheliomatous type.

Operation, upon his right, March 25th. Proved difficult in the extreme, occupying one and one-half hours, because of masses of cancerous adherent lymph-nodes, extending far down the neck, and compelling division of the sterno-mastoid muscle to admit of safe work. Also cleaning out of cancerous submaxillary glands, etc. Because of swelling causing obstructive respiration, a laryngotomy was necessary, early in the operation. The anæsthesia was conducted through the tracheotomy-tube. This was removed within two hours after the end of the operation. Into the occipital artery 3 cubic centimeters (about 45 minims) of the paraffin mixture were injected at 120° F. Through some small branches cut, perhaps 10 minims of this escaped. Into the superficial carotid close to the parotid gland 2 cubic centimeters of the paraffin mixture entered. No trouble whatever in either instance. The fluid entered without the least sense of resistance.

The patient stood the operation surprisingly well. He had primary union of his wound, and left the hospital to recuperate at home upon the eighth day.

No ill effect whatever from the injection technique. The cancer in the mouth was distinctly lessened in size.

Readmitted April 29th. Second operation, that upon the left side of his neck, next day. The unusually long interval between operations was compulsory, and due to a severe gouty attack, involving all his smaller joints: a thing to which he was subject occasionally.

This second operation proved rather simpler than the first:

one hour. It was preceded by laryngotomy through the old scar. The occipital branch received 4 cubic centimeters of the paraffin mixture; the termination of the superficial carotid and its bifurcation within the gland also 4 cubic centimeters. This was done because I had noted in his temple, on the right, a few days after the first operation, distinct pulsation of the arteries; so that evidently the smaller amount injected at the first sitting had been (in his case) insufficient. Following the injections the external carotid was excised, at each operation, and without tying off (except the ligation low down, which preceded the injection).

At the beginning of this operation the pulse was 115; toward the end it ran up to 135. Hence he received strychnine by needle, gr. $^1/_{15}$, and 2 liters of hot, intravenous saline infusion at 120° F., entering the median basilic vein. This had an excellent effect, bringing the pulse down to 110.

The respiration was, and remained, normal. As always seems to be the case after these injection operations at first, the face was swollen and mottled in appearance and tender to the touch; and, though the growth is to shrivel away later, at first, from passive congestion, there is actually some swelling of the malignant mass.

About six hours after the operation the temperature shot up rapidly to 104° F. Obviously this was not due to infection. Even had we not used every aseptic detail, as we did, the time was too early *post operationem*, to account for the rise in this way. Evidently a main cause of this rare condition was loss of control of the thermotaxic center in the brain.

This high temperature was maintained to the end, although for certainty the wound was opened and packed. The pulse continued weak; and upon the second day a slight degree of Cheyne-Stokes breathing was noted. Oxygen was employed, plus heart-tonics by needle; but the pulse went up to 140-150, and the patient died of heart-failure upon May 4th.

Unfortunately no autopsy was permitted, either in this case or any other, so far, of death following cases in which the injection-plan has been tried. Their number has been far too limited as yet to justify any conclusion as to the real value of this addition to the author's carotid-extirpation technique. The essayist realizes that the high percentage of mortality is calculated to deter other operators from trying Wyeth's sugges-

tion, but believes that when it is used in cases not so desperately far advanced toward death from their disease as were almost all of those studied in this concluding chapter of the essay, and profiting also by avoidance of such mistakes as the essayist has made in working in a wholly new and untried field, the results at the hands of other surgeons may be more encouraging.

Case XI.

(Case of Dr. F. G. Kneer.)

New York, December 15, 1902.

My dear Doctor:

In answer to your letter of December 8th I should like to state that during the month of April, 1902, I had occasion to meet two cases upon whom I did your "Gross Prize operation," after tying off the common carotid artery in the affected side.

Carcinoma in the Left Side of the Neck.

The first case was that of a man about 52 years of age, who had a tumor in the left side of his face as large as a grape-fruit. It involved all the glands on that side of the neck, was hard, and infiltrated all the surrounding tissues. It had been growing for about one year, and although no pathologist diagnosed, it was considered by the hospital staff, as well as myself, to be of a carcinomatous nature.

On April 7th, which was before I saw you regarding the details of the operation, I cut down in the patient's neck and tied off the common carotid artery. Two weeks later I again cut down in the same side, ligated the external carotid, and removed it, after tying off its branches, as you directed me to do. I did the same operation in the other side one week later. The paraffin I did not use in this case.[1]

The result was very disappointing. After the third operation the whole side of the diseased face sloughed off, and he died a week afterward.

Sarcoma in the Right Side of the Face and Neck.

My second case, which was operated on one week after the first, and a week before I saw you, also had his common carotid tied on

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[1] See comment by essayist at end of Dr. Kneer's letter.

the affected side. This man, 28 years old and single, had a very large mass in the right side of his face and neck, 7 inches long, 5 inches wide, and 4 inches high. It was a nodulated affair, and from its general appearance, I thought it to be a sarcoma. (As we have at present no pathologist at the hospital, it was not convenient to have specimens examined.)

On April 14th, the common carotid was tied. April 21st, which was a few days after I saw you, I removed the external carotid and injected about 3j of the paraffin and white vaselin mixture into the facial, occipital, temporal, and internal maxillary arteries on the affected side. The bandages were removed at the end of a week; everything had healed up nicely, and there was a perceptible shrinking of the tumor. Two days later the external carotid was removed on the other side, and paraffin injected the same as on the other side. At the end of another week this wound was almost healed. Three weeks after the operation the growth diminished so much that everybody noticed the improvement. The patient, though, was not satisfied; he wanted to be entirely rid of the thing, and asked me to remove the entire mass. This I refused to do, telling him to wait, and that such a procedure would be dangerous. I did not see him again, but his sister called on me a month later, telling me that he went to Dr. ——, who removed the growth, but the patient died the next day.

The only special thing I can report about these two cases is the severe headache they both experienced for about a week after the operation. Later on I would be pleased to call on you regarding a few cases I anticipate to do.

I am, yours very respectfully,

F. G. KNEER.

COMMENT BY THE ESSAYIST.—It is with some hesitation that the two cases of Dr. Kneer have been included herewith. In both instances he tied the common carotid to begin with. And in the first patient, this fact must presumably have been the cause of the sloughing of normal flesh; for in none of the large number of cases herein recorded has such sloughing resulted from superficial carotid extirpation upon both sides unaccompanied by injection. However, because of their interest the cases are included; though that without injection, which otherwise would have been tabulated and placed in the previous chapter, has, in fairness to the new operation, not been so included.

Case XII.

Epithelioma of Cheek.

John Bardelli, Italian, *æt.* 54. Sent to the essayist by Dr. Bernard Zweighaft, of New York City.

History: Denies venereal. Is a very heavy smoker, and has been so most of his life. Indeed, he was latterly unable to get enough "bite" from ordinary tobacco, and used to smoke and chew the nicotine-soaked tobacco scraped from the bottom of old pipes. As a rule, his quid was placed in his left cheek; and here was the seat of the malignant condition. This was an ulcer covering about one-half the inner aspect of the cheek; but radiating from it in all directions were the silvery lines of a leucoplakia buccalis. This was particularly interesting, since 25 per cent. of cases of leucoplakia, whether lingualis or buccalis, develop epithelioma subsequently; and here was a case most evidently springing from epithelioma as a cause. Dr. Jeffries pronounced a section from the base of the ulcer to be epithelioma.

This ulcer was of some eighteen months' duration. Latterly it had resulted in a partial locking of the jaws, compelling the use of liquid food alone. He was very cachectic in appearance, though still of average weight and muscular build.

Admitted to the Polyclinic Hospital June 2, 1902. Operation next day, assisted by house staff. His heart under the excitement of preparation for operation ran up to 135 per minute, and occasionally dropped beats.

His left superficial carotid was excised, after injecting its occipital branch with 3 cubic centimeters and its termination at the parotid gland with 2 cubic centimeters of the usual paraffin mixture, at the customary temperature. The entire procedure proved simple, though delayed somewhat by adherent lymph-nodes.

One hour ended it. But the pulse, in spite of ether anæsthesia, and strychnine by needle, was very rapid, irregular, and weak. The respiration remained normal, and he recovered consciousness from his anæsthesia; but in spite of all care his pulse failed and he died from shock about six hours after the operation.

This death was unquestionably caused by his badly to-

bacco-poisoned heart plus his cachexia. Probably the strain of any operation whatsoever would have had the same result.

Case XIII.

Epithelioma of the Cheek and Superior Maxilla.

(Operation by Dr. G. R. Fowler.)

Male, *æt.* 55. German Hospital, Brooklyn, N. Y.; admitted November 21, 1902. About a year ago a small nodule appeared on the left side of the face near the angle of the mouth, which increased slowly in size for nine months, and for the last three months has been growing rapidly, accompanied by pain. The gum became involved beneath the nodular swelling; the latter spread to about the size of a silver dollar, and ulcerated. The disease proved to be epithelioma, upon examination.

Upon admission the left side of the face was extensively infiltrated, and the alveolar process and floor, as well as the anterior wall of the antrum, involved. The left external carotid was extirpated to the bifurcation in the parotid gland; and the temporal and commencement of the internal maxillary injected with paraffin, as in the first case, 30 minims being left in. Upon the right side the external carotid gave way from the tension made, and the vessel was torn away, the tear occurring apparently just at the junction of the internal maxillary and superficial temporal branches. The retracted stump could not be recovered without prolonging the deep dissection to the extent of endangering the branches of the facial nerve, and no injection of paraffin was made on this side. The bleeding from the torn vessel was slight, and soon ceased with gauze pressure.

Several enlarged glands were removed through the incision made for the extirpation of the external carotid.

The patient's condition at the time of writing is as follows: The discharge from the ulcerated skin and mucous membrane surfaces has ceased, and the swollen and infiltrated appearance of the face has disappeared. The pain previously

complained of is no longer present. The general appearance of the disease, as well as its apparent limitations, have so far altered that an attempt at radical removal is seriously considered.

Case XIV.

Round-Celled Sarcoma of the Antrum.

(Operation by Dr. George R. Fowler, of New York.)

Female, *æt.* 45, German Hospital, Brooklyn, N. Y.; admitted November 12, 1902. History of swelling of left cheek first noticed eight weeks before operation. No pain nor discharge. Increased rapidly in size. Exploring needle in hands of family physician negative. Transillumination showed both antra alike, but dark. Upon admission exploratory operation through canine fossa showed the thinned antral wall anteriorly to the growth, and the latter extending as a soft mass into the spheno-maxillary fossa. Section of portions removed shows small round-celled sarcoma. Diagnosis: Round-celled sarcoma of antrum.

Operation, November 24, 1902. External (left) carotid tied close to its origin, and divided. All branches tied off in succession to the terminal. On right side the internal maxillary branch could not be reached without danger of tearing the external carotid across by excessive traction. The latter was therefore cut across, and a cannula of previously measured length passed to a point in the terminal estimated to be well beyond the internal maxillary branch. The cannula, before introduction, was attached to a syringe loaded with paraffin with a melting-point of about 115° F., but heated to 120° F. The cannula was heated, filled with this paraffin, passed beyond the internal maxillary opening, and emptied, the cannula being withdrawn as it was emptied. Thirty minims was the amount introduced. Before complete withdrawal a ligature was placed about the stump of the vessel, and tied as the cannula was removed. This part of the operation was done with the object of substituting, as far as possible, occlusion of the commencement of the internal maxillary and

the terminal (temporal) artery for ligature of the external carotid beyond the internal maxillary. The opening in the mouth through which the growth had been previously explored was now enlarged and the whole diseased mass, as far as could be estimated, curetted away. The curette was carried well back into the spheno-maxillary fossa, and the naso-pharynx reached finally, the inner wall of the antrum being involved in the growth, and breaking down readily. The hemorrhage from this procedure was slight.

The patient's altered appearance was most striking, and up to the present time (December 15th) there is no indication of the reappearance of the tumor. She is now free from pain.

Case XV.

Small Round-Celled Sarcoma.

(Operations by essayist.)

Case sent by Dr. Frederick Whiting, of New York: Arthur H. F., of New Haven, *æt.* 34. Family and personal history negative. Disease began seven months before admission to Polyclinic Hospital with a rapidly developing tumor plugging, first, his left side of naso-pharynx and nose; later, both sides. Pressure gradually produced partial deafness from obstruction of the Eustachian tubes. Of late considerable and increasing pain from pressure. Upon his left, large masses of lymph-nodes in the carotid region and well beneath the sterno-mastoid; to a much lesser degree also upon his right. Developed a slight, but noticeable, swelling of his left temporal region within the past month. Professor Jeffries examined a piece removed from the intranasal mass, and gave the diagnosis named above.

First operation upon his left, December 1, 1902. This proved, as anticipated, difficult in the extreme. The sterno-mastoid was divided below its middle, for light, and it was found impossible to take away the sarcomatous masses of glands without also tying and removing therewith practically the entire deep jugular vein, which was imbedded in them and itself diseased. Next the usual operation was performed upon

the superficial carotid, followed by paraffin mixture injected into the occipital branch: 30 minims, and as much more in the carotid-end at the parotid. Operation took an hour and a quarter. Patient lost so little blood that there was no shock; and primary healing followed.

He returned to New Haven to recuperate prior to his second operation. This took place January 6, 1903. In certain respects it proved the most interesting and instructive of this whole group. Because of the first operation, when first ether, then chloroform had been tried, and were badly taken, we determined to use, for the first time, minor anæsthesia. Accordingly a weak cocaine solution was employed (1 per cent.). This worked excellently; the glands (less extensive than upon the left) were excised; the superficial carotid was being extirpated from below upward as usual, and the occipital had just been tied off and divided when the patient, up to this time able to answer questions, and quietly volunteering an occasional remark, ceased suddenly to speak. A glance showed him unconscious, and at the same time great congestion of all superficial veins about the face and head developed. The operator at once surmised what proved to be the truth, namely: that the blood in the only remaining deep jugular had clotted while being pressed upon, high up, behind the ramus, by a blunt retractor; and that in consequence a terrific degree of passive congestion of the brain developed. Of course, the operation was ended at once at this point, and the patient's head elevated and all possible measures taken to save him; but he did not recover consciousness, dying about twenty hours later.

Fortunately an autopsy of the head was permitted: the only instance in this entire series, where death had occurred, in whom it was allowed. This showed, first, that the patient was, indeed, fortunate in dying as he did; for the sarcoma had, through the inner and rear wall of his left orbit, involved the adjoining frontal lobe of his brain; also had eroded the left temporal bone, and developed beneath his temporal muscle here, causing the slight swelling noticeable, to which earlier reference was made. Upon his left, the blood in the lateral and petrosal sinuses was found fluid, although the deep jugular on that side had been excised, it will be remembered, at the first operation. But the sinuses of the same name upon his right were found entirely filled with a blood-clot.

Plainly, a lesson is to be drawn from this case, namely: never to operate upon the sound or comparatively sound side of the neck first when the worse side has such severe glandular involvement as to make it in the least likely that the deep jugular will have to be tied off, from adhesions or from being torn during the work.

It is evident that, in this man's case, had this rule been followed he would not have died as he did, though, as it chanced, this was best for him. If we had first attacked his right carotid region, probably blunt pressure of retractors upon the deep jugular would not have induced stagnation of blood, and hence clotting, for the other deep jugular would have performed its function.

There are other reasons, mentioned in the chapter upon "Technique," for advising operating upon the sound side first; but this is a yet stronger reason, at least when severe glandular disease is present in the neck upon one side.

Case XVI.

Epithelioma of the Face.

(Operation by essayist.)

Mrs. Henry E., *æt.* 58, patient of Dr. John A. Munson, Woodbourne, N. Y. Sent to the author by Dr. Shirley E. Sprague, of New York City. First developed cancer of the face fourteen years ago. This was destroyed by caustic. Returned five years ago, and at present there is an ulcerated area involving the right upper lip and ala of nose, about the size of a silver dollar; but the induration is extensive, reaching to the orbital margin, and may be felt upon deep palpation, extending backward nearly to the ear upon this side. The edges of the ulcer present the typical waxy appearance. Excision of a specimen; reported by Dr. Jeffries to be typical epithelioma.

Admitted to Polyclinic Hospital. First operation, upon her sound side, January 10, 1903. The usual excision of the superficial carotid in its entirety was easily performed, no glands being in the way. Next the occipital branch was

plugged with 35 minims of the usual paraffin mixture at 120° F., and 30 minims more were injected into the carotid stump at the parotid gland. No unpleasant symptoms; and a primary union followed.

Second operation, upon her right, performed January 27th. This was more difficult because of masses of glands in the way; otherwise this operation may be said, for brevity, to be the exact duplicate of the one upon her left, just described, and including the injection-technique.

The face, especially upon the diseased side, at first swelled, and looked passively congested and also mottled in color. This seems the rule for a day or two after the operation in which the injection-plan has been used. After this short period the swelling rapidly subsided, and the induration (to be felt very extensively on deep palpation beforehand, as previously stated) quickly diminished; until it was, within a fortnight or so, practically gone. Meanwhile the ulcerated portion sloughed extensively. This process of disintegration did not involve any of the normal flesh, nor even the entire lower edge of the cancer. As soon as the sloughs separated there was rapid filling in by granulation-tissue; and, by the time she left the hospital to return to her home, in major part the formerly cancerous surface had healed over with apparently normal tissue. The lower edge, however, remained unhealthy in appearance, though much smaller than upon admission. We advised her to remain and permit the use of the Roentgen rays. This she only allowed for three treatments, within a week, and then insisted upon withdrawal, upon February 20, 1903.

The results of the starvation-treatment in this case were remarkable, especially in view of the five years' duration of the cancerous recurrence. Dr. Sprague informs the essayist, early in May, 1903, that the local improvement has steadily continued.

It was regretted that she did not accept advice as to the x-rays. It seems to the author likely that in instances where malignancy is extremely advanced, as here, both measures—the operative for starvation, and the rays—are likely to accomplish more than either alone could do.

CASE XVII.

Carcinoma of the Cheek and Lower Jaw.

(Operators, Drs. Bristow and W. F. Campbell.)

John Johnson, *æt.* 48, Swedish, laborer. Family history unimportant, except that his mother died, at 38, of a tumor of the stomach, he thinks. Previous personal history negative; alcohol used moderately; pipe-smoking to excess.

Present disease: In August, 1902, noticed a small painful growth between gingival and buccal surfaces, left side, lower jaw. This rapidly enlarged, spreading through the thickness of the cheek. Internally the disease has attacked the bone of the mandible, which upon admission is necrotic from symphysis to ramus upon his left. Disease has caused great left hemicranial headache. There is of late a constant foul discharge from his mouth through a sinus in his cheek. His digestive condition, doubtless in part from swallowing some of this secretion, is deplorable, and he is very cachectic. Dr. Van Cott, pathologist, made the definite diagnosis indicated at the heading.

Patient admitted to Kings County Hospital, and first operation was performed, upon his left, by Dr. Bristow, February 12, 1903. The usual excision of the superficial carotid was followed by injecting 30 minims of the paraffin mixture heretofore named, at a temperature of 120° F. Was returned to bed in a satisfactory condition. But next day, with a pulse of 80 and a normal temperature, the same side of his face was much swollen and red, and entirely anæsthetic; also, he swallowed with the greatest difficulty. These symptoms, however, passed off entirely in about three days. It is difficult to account for their advent. (He had previously had a treatment by the Roentgen ray.)

Upon February 26th the same operation was repeated upon this patient's right; this time by Dr. Campbell. Because of much difficulty in resuscitating him from respiratory failure just at the stage where work about the occipital branch, and the "dive" is being done, it was thought wise to omit the paraffin injection.

The patient made an excellent recovery. The house surgeon reports to the essayist late in March: "Patient's condition is at present excellent. He eats and sleeps well, and feels fine in general. A marked shrinkage in the growth is noticeable." (Also note Dr. Bristow's comment at the end of the report of the case of Philip Coyle.)

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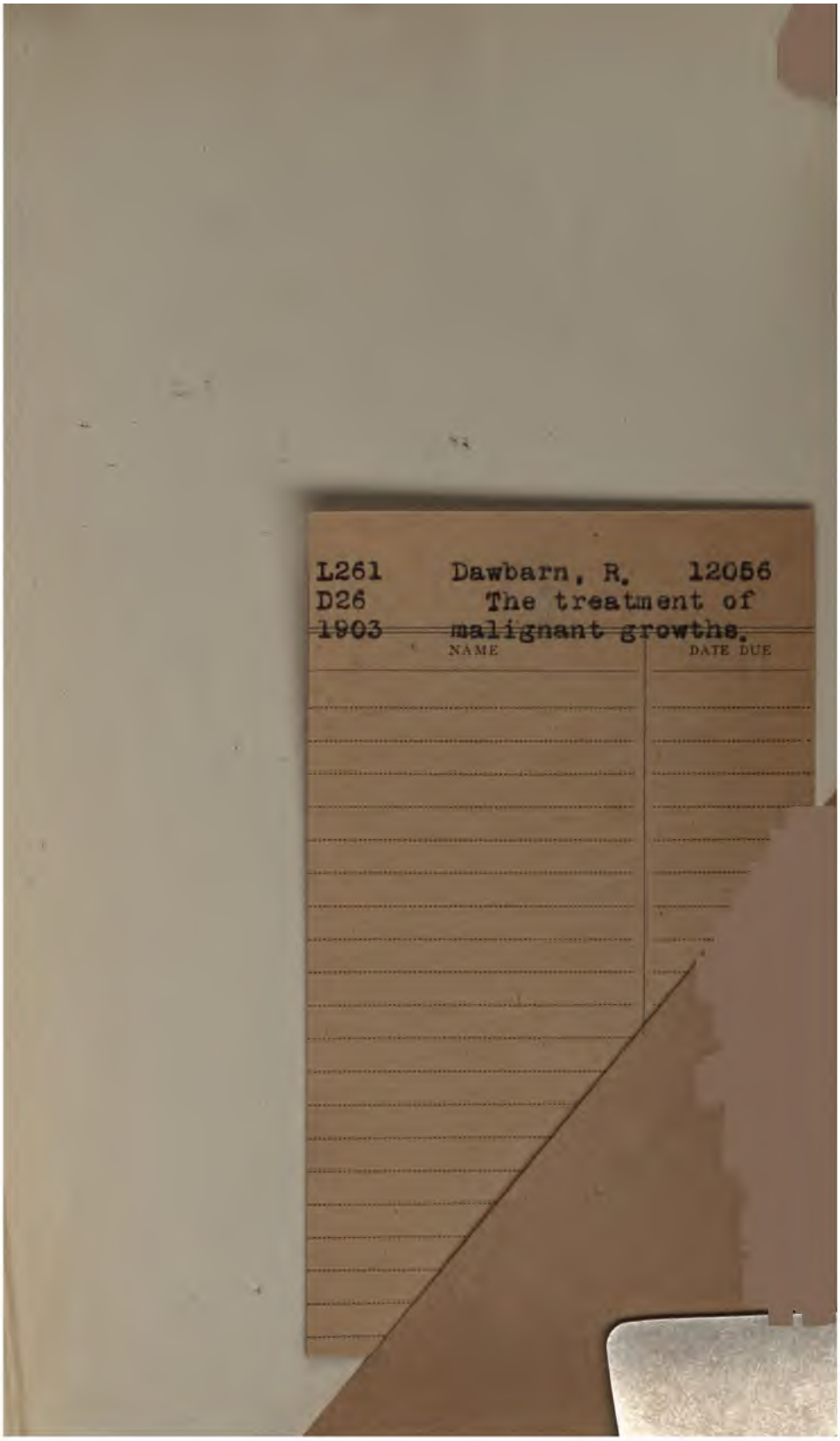
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